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Fertility and Infertility in the Cow

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The first thought that strikes one when attempting to write a paper on infertility is that every aspect of the subject has been written up over and over again and it is almost impossible to introduce anything new or original. Even if one's own views are unorthodox, one finds in a very short time that other observers have followed suit, so that any claim to originality which one may have possessed has soon vanished. Apparently, nothing less than a world war could have raised the study of cattle diseases from the obscure and undignified position which it has held for the last half-century on to the pinnacle of importance where it rests at the present moment. Perhaps "rests" is hardly the right word, for there appears to be no such thing in this modern rush into the elucidation of bovine maladies as "rest." Fresh discoveries are reported weekly, and even if some of these are contradicted shortly after publication and others are soon forgotten, now and then something noteworthy comes to light, leaving us with a fresh viewpoint or with some new technique, which may prove useful in our daily work. Our knowledge has been advanced by the enthusiastic research of the younger generation of veterinarians. Young graduates, specialising in nearly every branch of veterinary science, have become, almost suddenly in some cases, cattle-minded. They have invaded the cowshed, whereas their work was originally confined to the laboratory, to such an extent that one may be forgiven for wondering whether, as their enthusiasm increases with practice, there will eventually be any room at all left for the cow. This animal, formerly regarded as the lowliest of our patients, amenable only to the probang and the saline purge, has suddenly developed amazing potentialities. Instead of posing as the phlegmatic bovine, as of yore, she has now exhibited a very highly developed nervous system, she has a hormone output far more intriguing than that of any other of our patients and her physiological processes are polished up to a very high standard of efficiency. In fact, her suddenly acquired importance has imbued her, during her lifetime, with all the virtues one would have expected to have read only in her obituary notice.

No doubt, the infusion of fresh talent into our midst has hastened the rate of progress, for the great majority of our more recent converts are intolerant of delay. . . . But it must be remembered that advancement in knowledge is not always proportionate to the speed at which one reaches conclusions and, in the past, a very great amount of sound clinical knowledge has been accumulated through a steady, if somewhat laborious, system of trial and error. I still pay tribute to the little-known practitioners of the past century who, handicapped by lack of basic science and working without modern apparatus and appliances, laid down the foundations of our present knowledge. They were the unsung explorers of veterinary science and it is entirely owing to the patient clinical research which they carried out that we possess to-day that basis of knowledge to which we are able to apply our more modern technique.

If I presumed to criticise the younger generation of bovine experts, I would suggest that they are too inclined to regard the modern cow as a machine, into which you drop the penny at one end and receive your milk and manure at the other. Just as the small boy on the railway station gives the automatic machine a few hearty thumps in the hope of increasing its output, so these modern enthusiasts rack their brains for new methods of giving the long-suffering cow some sort of a jar, by means of which she may be stimulated to an ever-increasing yield. They are apt to overlook any pieces in the puzzle which do not fit into their own particular section of the picture and, so, they sometimes forget that nutrition, environment, production and fertility are all intimately bound together with a common purpose. Neither do they realise that, being female, the cow instinctively does the thing which you expect her least to do and that she retains the privilege of her sex and changes her mind quite frequently for no apparent reason, especially in regard to her breeding technique.

I am inclined to believe that, in many respects, the older generation was sometimes more sound in its reasoning than the present, particularly in regard to some aspects of animal husbandry. Our ancestors did not require impossibilities, therefore they did not seek them. They were content with a pint of milk when they had no particular need of a quart. Infertility in bovines, as we know it to-day, is largely the outcome of modern commercial methods of production, impatient for rapid progress and demanding an ever-increasing output with no regard for the physiological welfare of the donor. The cow has doubled and trebled her normal output, but, unfortunately, she still possesses only one mouth and one set of digestive organs, to cope with the additional drain upon her resources. In modern research, a better knowledge of endocrinology and bovine physiology must be linked with the realisation that the cow is a creature of flesh and blood; she must no longer be considered a machine. Abnormal production goes hand in hand with lethal factors which, if unchecked, will shortly eliminate the bovine species.

It is perhaps a little unfortunate that our knowledge concerning the aetiology of infertility has kept steadily in advance of our capability of applying successful treatment. It is equally unfortunate that the farmer still remains sufficiently behind the times to judge us by the results we achieve rather than by the wisdom we assimilate.

Routine Examination

Before commencing to examine animals individually, it is well to note the conditions of management and the environment of the herd generally and to determine if the treatment of the affected animals has differed in any way from that of animals which at the time appear to be normal. When infertility has been in existence for a while, one must distinguish between herds in which a large proportion of the animals present appear to be affected and herds in which the incidence is low. In other words, one must be prepared to differentiate between individual and mass infertility. Factors influencing nutrition, milk yield and bodily condition must be considered and the milk yield, breeding history and the existence or absence of contagious abortion or other infection in the herd must be enquired into. In most cases the practitioner will be already aware of the conditions prevailing.

It is always wise to ascertain, particularly on small holdings, whether a communal bull is used, if he has a good record and (very tactfully) whether neighbouring farmers have also made complaints regarding the results of his services. The use of one bull on many holdings raises a question which does not arise on larger farms, where no cows from outside sources are introduced for service.

The regularity or otherwise of the oestrous cycle must be ascertained and also the occurrence or absence of vaginal discharge.

Having made all the necessary enquiries, one may proceed to the more intimate examination of the animal. I do not propose to bore you with a long account of the procedure, for it must be familiar to you all, but I will make a few comments on the various steps, with some slight reference to the anatomical features.

In the heifer, the uterus is small and can be covered by the palm of the hand. Normally, it should be wholly contained within the pelvis, but it must always be borne in mind whilst making an examination that the uterus is a muscular organ with a great deal of variation in its muscular tone and that it possesses the power of contracting when touched or stroked by the hand through the rectal wall. This "erectile" action is consistent with health and is partially or wholly lost in certain diseased conditions.

As the animal advances in years, the uterus becomes larger and shows a tendency to straighten out, partially as the result of the development of longitudinal folds and partially owing to the great increase in the thickness and particularly in the width of the body of the organ. In animals which have borne numerous calves, this lengthening becomes so marked that the greater part of the non-gravid uterus may lie in front of the pelvis so that it becomes impossible to make a complete examination unless vulcellum forceps are applied to the cervix per vaginam, and the whole organ is drawn back into reach. An alternative method is to attempt to hook the finger into the intercornual ligament, which joins the two cornua in the cow. Even then, if healthy, it will respond to stroking so that it contracts into a firm mass which is, for the time, almost wholly intra-pelvic. Any uterus which cannot be brought into reach by the methods above mentioned may be pregnant, hyperplastic or affected with endometritis or pyometra.

Apart from age differences, variations in the size and position of the uterus may be associated with breed. In Guernseys and in

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Jerseys, the organ is far more often intrapelvic and generally smaller than in Ayrshires, Shorthorns or Friesians. In the Channel Island breeds, the vaginal passage is proportionately shorter than in the other breeds mentioned and the cervix is accordingly closer to the vulva.

In the non-gravid uterus, the horns are firm on pressure and possess a degree of elasticity when in a normal healthy state. The hyperplastic uterus, which as will be shown later, results from physiological causes and has in the past been so frequently described as being the subject of endometritis, is softer, inelastic and " doughy " on pressure. The two horns are usually similar in size excepting in certain cows which have borne numerous successive calves in the same horn. This disparity is quite normal.

In some cows, the uterus is carried out of the mid-line, when non-pregnant, tucked away in the right iliac fossa, into which it is usually directed by the pressure of a full bladder plus a full rumen. Such cows usually have a firmly contracted uterus which is quite healthy.

I need not discuss pregnancy diagnosis at any length, in spite of its major importance to the practitioner who is called in to determine why any particular cows exhibit recurring oestrus, because I well recollect the very practical paper which Mr. Burgess recently presented and which was published in *The Veterinary Record*. I must, however, impress upon my hearers at this point that the fact that a cow comes into season at regular three-weekly intervals is not proof that she is non-pregnant and catastrophe can easily follow attempts to irrigate the uterus of such animals without having first made a complete examination of the uterus per rectum. I will only mention, in this respect, that at from six to eight weeks which is the most important time from the viewpoint of the practitioner who sets out to treat infertility, the main feature is that the non-gravid horn remains firm to the touch, whilst the gravid horn feels thinner and contains a small amount of fluid which travels along the horn in front of the finger, when the horn is gently stroked. No attempt should be made at this stage to detect the presence of the tiny foetus, as even moderate pressure may cause bursting of the amniotic sac with the production of either abortion or pyometra. The ovary of the pregnant side will contain a rounded corpus luteum, of which the chief evidence is the disparity in size of the ovaries which is not due to the presence of fluid. The presence of the corpus luteum is no evidence of pregnancy as it is, at this stage, indistinguishable from the C.L. of oestrus, which is of similar size at about the tenth day; or the C.L. present might be the retained C.L. of pregnancy accompanied by pyometra. The absence of a C.L. would be better evidence of non-pregnancy, but in any case where a corpus luteum can be palpated further examination ten days later will clear up all doubts as, in the case of pregnancy or pyometra, the ovary will remain as large as at the first examination, whereas if the C.L. felt then had been that of oestrus, it would have regressed by this time and a follicle would be plainly palpable in the same or opposite ovary. Not infrequently multiple follicles may be present. It is interesting to note that several medium sized follicles may occasionally be present, in addition to the C.L. during the first two months of pregnancy.

Hyperplasia of the uterus, so often confused with endometritis, is characterised by enlargement of *both* horns, which are straightened out and fall partially over the pubic brim. Their tonicity is lost and they retain but little contractile power. They are flabby to the touch and have a " dead " feel. Within their lumen there is little or no fluid palpable. This condition offers an excellent opportunity for the multiplication of bacterial flora normally present in the genital tract or introduced by various agencies, with the result that an endometritis may supervene.

Hyperplasia must not be confused with twin pregnancy. In practice, it is usually found that twin pregnancies originate in one horn. When one finds enlargement of *both* horns with only one corpus luteum in the ovaries, one may suspect some condition other than pregnancy. It is still possible to confuse pyometra involving one horn only, particularly as the amount of pus may increase at about the same rate as the fluids in normal pregnancy. Most cases of pyometra originate in one horn and extend to both horns as soon as digestion of the foetal membranes has occurred. After three months, a cervical seal may sometimes be present in cases of pyometra and several observers have recorded fremitus in the middle uterine artery.

Pregnancy diagnosis, in the cowshed, is not always the simple matter it appears on paper. It is quite easy to make a mistake when all that can be felt is the uterus passing out of reach over the pubic brim with both ovaries out of reach. There are other indications of pregnancy, such as the presence of the cervical seal and pulsation or fremitus in the arteries, but reliance on these may let one down. One should always be on the look-out for mummified foetus in the uterus, not forgetting that such a foetus may lie in the anterior vagina for several weeks before being expelled through the vulva.

Vaginal Examination.—This is seldom possible in heifers without the aid of an illuminated speculum. Observe the lips of the vulva and note whether they form a perfect seal to the vagina or whether they are deformed from recent or previous tearing, so that faeces and air can pass into the passage. When the labiae are parted, one may observe a number of small pink or brick-red papular elevations, the majority of which are situated in the region of the clitoris but are occasionally quite numerous on the lateral walls of the vagina. In cases of endometritis and vaginitis, any irritant discharge causes these papules to become very prominent and cows and heifers thus affected have frequently been quite erroneously stated to have been suffering from contagious granular vaginitis.

One should carefully examine any discharges obtainable from the floor of the vagina and, at the same time, ascertain the condition of the cervix, noting whether the cervical canal is firmly closed or relaxed, or if the cervix is larger than is normal. In old cows, some of the cervical rings may protrude from the os, whereas in heifers and young cows, the cervix is smooth, firm and rounded. In oestrus, the os is slightly relaxed and the vaginal exudate is increased in volume, being clear and mucilaginous.

A clear or slightly turbid fluid containing small white flocculi may be associated with trichomonas or endometritis. Advanced cases of endometritis may yield creamy or sanguinolent pus. Green pus is supposed to be characteristic of *C. pyogenes* infection, whilst brown or chocolate-coloured evil-smelling pus may indicate the presence within the uterus of a decomposing foetus. As a matter of fact, the nature of the pus affords very little real evidence as to its causation; most infections are mixed and a great deal of variation may occur.

A large number of cases of true endometritis are associated with cervicitis and the protrusion, even in fairly young animals, of the cervical rings through the os. In early hyperplasia, the cervix is usually firmly contracted and it is by no means easy in every case to effect the introduction of the uterine catheter.

Early pyometra cases are frequently associated with a closed cervix. Sometimes, if the pregnancy has been in existence several months prior to the death of the foetus, a well-marked seal may be palpable, but when the condition is advanced, the cervix is usually sufficiently dilated to permit the passage of one or two fingers and pus may be exuding from the vulva. In pregnancy a cervical seal, reaching to and palpable at the external os, is present in about 75 per cent. of cases only.

Let us now consider the ovaries. They lie, one on either side, at the level of the bifurcation of the cornua, usually close to the shaft of the ilium. It is essential that one should learn to distinguish blindfold the presence in an ovary of a follicle or a corpus luteum and to realise the difference between an ovary containing several normal follicles and one containing one or more cysts. This always seems easy when the ovaries are lying on the table, but not so easy if they are first covered with a cloth and one feels through the cloth in a similar manner to which one would feel through the rectal wall. It is even more difficult in the living animal.

As you know, the corpus luteum develops in the crater formed by the bursting of a follicle. For the first two days, it resembles a small haematoma, then it appears as a small brown or brownish-yellow projection on the ovary not unlike the nipple on a breast. By the 12th day it has grown until it comprises about five-sixths of the total ovarian mass. It is now a bright golden-yellow in colour. About the 14th day, it commences to regress, slowly at first, and at about the 18th it has shrunk until it constitutes only about one-fifth of the mass, being then a true orange in colour. Elder, in 1925, found in making a detailed microscopic study of corpora lutea from pregnant and non-pregnant animals that the corpus luteum of oestrus and that of pregnancy undergoes fatty degeneration at the end of the 21-day period and at the termination of pregnancy respectively.

By the 16th day, one or several Graafian follicles will have developed alongside the corpus luteum or within the other ovary. One of these will continue growing, sometimes more than one, and the remainder will shrink to a small size. Even when pregnancy supervenes it is quite common for several moderate sized follicles to persist throughout the first few months.

Although the C.L. of pregnancy cannot be distinguished by touch from the C.L. of the 12th day of oestrus, yet if one examines a *post-mortem* specimen, one may observe that in pregnancy the epithelial covering of the ovary is denser and more complete than in the case of the C.L. of oestrus.

Now, unfortunately, corpora lutea do not always observe the rules of procedure laid down for them and either the C.L. of oestrus or the C.L. of pregnancy may fail to regress at the appointed time and, instead, it remains in position, being then referred to as the " retained corpus luteum." Normally, in the cow the C.L. of pregnancy regresses at about four to five weeks after parturition, with return of oestrus at about the sixth or seventh week in Guernsey cows maintained in S.W. England. Variation may occur according to age, breed, nutrition and the season of the year. The period is longer in winter than in summer.

Retained corpus luteum is associated with a condition of anoestrus which, if untreated, may persist for many months. On rectal examination, the retained corpus luteum following oestrus may be palpated, as also may that of pregnancy, if an attempt is made a week or so following parturition. The retained corpus luteum has usually shrunk to some extent, so that when grasped through the rectum, it feels, when the whole ovarian mass is grasped in the hand, somewhat like a small " Sorbo " ball.

According to the best authorities, these retained corpora lutea should always be expressed, whenever and wherever the practitioner can get at them, either by squeezing the ovary in the hand or, alternatively, by grasping the C.L. in the hand and pushing the ovary away from it. As a matter of fact, if one collects a number of ovaries in the metoestral stage or containing the retained corpus luteum of the preceding pregnancy, one will find that the only one which can usually be expressed without a great deal of difficulty or actually splitting the ovarian body in the process, is the one taken at about the 12th day following oestrus. It would be very unwise to suggest to budding practitioners in the treatment of infertility that the operation should be attempted at any other time. To suggest that they should examine herds of cows, in which the members are in all stages of the oestrus cycle and express C.L. indiscriminately would be nothing less than criminal.

There has been a great deal of discussion from time to time, concerning the risk of fatal haemorrhage following expression. It must be admitted that some practitioners go on for several years without a death, but nevertheless, it is surprising what a large number of veterinary surgeons concerned in this class of practice with whom I have discussed the subject, freely admit having had one or more deaths result from the treatment. I believe that the percentage must be considerably higher than is generally admitted, as it has been proved by several observers experimentally that a certain and often serious degree of haemorrhage follows *every* expression, and it depends upon several factors whether the haemorrhage rapidly subsides or whether it persists to the extent of producing clinical symptoms or death. Retained corpus luteum is frequently associated with calcium deficiency and many cases occur during winter when there is an insufficiency of ultra-violet light. Calcium is essential for the maintenance of normal tone in the uterus as well as being necessary for the formation of a blood clot, and therefore there may be a connection between retained C.L. and an increased tendency to haemorrhage. But however much or little truth there may be in this theory, it is quite certain that even one or two unexpected deaths in a village will not increase the practitioner's popularity as a fertility expert, and having myself enjoyed a brief respite, during which the local farmers " would rather I didn't put my hand in the cow," I now resort to the use of oestrogenic hormones to help bring about regression. Fortunately, human memory is short !

Graafian follicles can be felt quite easily during the last few days of the oestrus cycle, that is to say, during pro-oestrus. They tend to bulge beyond the surface of the ovary and contain fluid under pressure. During oestrus in the cow, they burst if handled. Ovarian cysts are primarily follicles which have failed to burst and instead of bursting have continued to increase in volume. They appear to possess a thicker covering than ordinary follicles, possibly owing to a lack of the anterior pituitary hormone, Prolan B, which causes the follicle wall to become thin and eventually to rupture. In cystic conditions, not only the follicles near the surface of the ovary, but also those situated in its depths, which normally would not have become active for some time later in the animal's breeding career, become stimulated and so cysts are formed within the substance of the ovary which have no opportunity of coming to the surface and bursting. Fibrous tissue forms around these and the ovary enlarges. Multiple cysts may form in this manner or, as often happens, only one or two large cysts may develop.

Contrary to general belief, nymphomania is by no means a constant feature of cystic ovaries. It is dependent upon the formation and absorption of excessive amounts of ovarian hormone from the follicles. Abnormal sexual desire is more frequent when the cysts are small and multiple ; when large cysts are present in small number, anoestrus is more likely to result. Occasionally ovarian cysts cause the cow constantly to ride other cows and equally constantly to refuse the bull. Hydrosalpinx has been observed to cause similar behaviour. Cystic ovaries are by no means so common in cows as has been generally believed. In the past, anything from a corpus luteum to a follicle, which disappeared when sufficient pressure was exerted upon it, was regarded as a cyst and so the great majority of cases of infertility were ascribed to the presence of cystic ovaries. The error has not yet, in all cases, been eliminated from practice.

The Fallopian tubes must be carefully palpated, for where there is any considerable degree of salpingitis present, treatment is only a waste of time and money. For a concise and thorough description of the disorders associated with these structures, I recommend you to read or re-read the paper presented by L. E. A. Rowson, of Uttoxeter, to the Derbyshire Division and reported in *The Veterinary Record* of August 1st, 1942.

As a general rule, it may be considered that the normal Fallopian tube is of such small diameter that it can only with difficulty be palpated with the finger tips through the rectum. It would be more correct to say that its situation may be determined rather than the actual tube. One which could readily be palpated would, in all probability, be abnormal. By introducing the fingers into the ovarian bursal pouch it is possible to determine whether or not adhesions exist, either across the pouch or stretching from the ovary to the wall of the bursa. Rowson states in the paper mentioned :– " A point to be stressed is that it is the severity of the condition and not its presence, that decides whether the animal is permanently sterile or not, for animals have been found pregnant in which the bursa of the pregnant horn has shown slight adhesions. It is quite impossible to attempt to fix a definite state of this condition, above which lies permanent sterility and below which lies probable fertility, for slight affections at one section of the tube may be sufficient to occlude it at that point and, although the rest of the tube may be clear, such an animal would obviously be sterile on that side. Even slight adhesions should therefore be treated with suspicion and a guarded prognosis given."

Rowson describes the pouch of the ovarian bursa as having the feel of a pocket turned upside down. The method by which I find the pouches is as follows : to locate the left ovarian bursa, introduce the right hand into the rectum and grasp the left ovary between the thumb and second fingers. Pass the index finger beneath the ovary on its antero-external aspect and extend the finger outwards and forwards. Let the tip of the finger travel in an arc until it enters the pouch. To find the right bursa, hold the right ovary between the thumb and first two fingers, pass the third finger beneath the ovary on its antero-external aspect and extend the finger outwards and forwards and sweep round as described in the case of the opposite bursa. The Fallopian tube runs along the free border of the pouch, directly beneath the thumb, in the form of an arc, with the concavity extending away from the centre of the free edge.

Rowson stated in his paper : " Considerable differences will be found in the size of the pouch in heifers from that in cows. In small heifers, the pouch appears to be much closer to the ovary and is of such size that only two fingers can be inserted into it, while in older cattle it is frequently possible to introduce all four fingers, and the pouch is much further forward—so much so that it is necessary to draw the ovary back before the fingers pass into it. It is necessary to take in a fold of rectal wall in order to allow for extension of the fingers into the pouch of the bursa." Actually, I find it better to pass the hand into the first portion of the descending colon and draw the bowel back towards the pelvis.

Infertility Arising from Infection

I propose to discuss briefly, in the first place, infertility resulting either from direct or indirect infection of the genital tract by micro-organisms or protozoa. Time will not permit a full description of these conditions, nor is this necessary, as they are all well known to you. I will make a few comments upon certain aspects, so that you may discuss them later.

It must be accepted that generalised conditions, such as Johne's disease and tuberculosis, may cause infertility by upsetting the oestrous cycle, but it is noteworthy that when once conception has occurred, unless there is a definite metritis present, as often happens in tuberculosis, that cow will probably carry her calf to full term and the condition of the calf at birth will compare very favourably with the bodily condition of the mother. It is remarkable that cows affected with advanced chronic disease of vital organs seldom abort, although loss of the calf during acute febrile conditions is not uncommon. In March of this year (1942), I saw an aged Guernsey cow in the last stages of emaciation, unable to rise. On the day following my visit, whilst awaiting the arrival of the knacker's cart, she calved normal twin calves, both being heifer calves. On *post-mortem* examination, the cow's liver weighed half a hundredweight and was composed of masses of pyogenic abscesses, very little trace of liver tissue being visible on section. Yet this cow completed a normal parturition !

Foremost among the infections which give rise to mass infertility, as well as to individual cases, we must place brucellosis. Not only does it cause loss of the foetus in a considerable proportion of infected animals, but it also exposes the uterine tract to the risk of secondary infections with the eventual setting-up of endometritis. Although recovery is usual, the period of sexual idleness may run into many months. I do not consider this type of endometritis as very serious. It possesses a nuisance value but it usually recovers in time. Trichomonas is blamed in many parts of the country for conditions of vaginitis, abortion and pyometra, and their importance will be discussed presently.

It cannot be too strongly impressed upon my audience that in those parts of the country which specialise in milk production, where the

worth of a cow is estimated in gallons per year, infertility is almost equally rife in herds which are free from both these diseases. The importance of specific infection as a primary cause of sterility may, therefore, in many cases have been unduly exaggerated.

Taking these diseases of infection in order, let us first consider :—

Vaginitis.—This condition may be *primary*, resulting from direct infection from the bull, or from external infection, or it may be *secondary*, when it is dependent upon infection from cervical or uterine discharges. The chief primary infections in this country are : (*a*) vesicular vaginitis ; (*b*) contagious granular vaginitis ; (*c*) Trichomonas vaginitis.

Vesicular vaginitis is not very important as it is easily discernible and yields to treatment. It is not always a bar to conception, even in the case of the infecting service. Occasionally, a cow which shows no clinical signs may be a carrier over a prolonged period.

Contagious granular vaginitis.—I must confess that I know very little about this condition. I have encountered outbreaks which have been diagnosed as granular vaginitis, but there has often been a doubt in my mind as to whether the papules did not really represent an exaggeration of the mucous follicles normally present in the walls of the vagina. These are most numerous around the clitoris and when vaginitis from any cause is present, they become inflamed and larger than normal. I have frequently had these pointed out to me by stockowners and others as evidence of disease. It is difficult to decide on the available evidence whether the lesions encountered represent a disease capable of causing infertility or whether they arise owing to some alteration in the vaginal *p*H, originating from some other cause, infective or physiological. In this theory I may be completely wrong, and I hope to-day to learn from your discussion.

The outbreaks which I have seen and which have been ascribed to this infection, appeared to grow worse when antiseptic and possibly irritant antiseptics were used as injections, but all cleared up, slowly but surely, when treatment was discontinued.

Trichomoniasis.—Once again, I am uncertain as to the actual part that trichomonads play in inducing infertility. I am convinced that these protozoan parasites may be associated with widespread loss arising from failure to breed, early abortion and frequently with retention of the dead foetus with resulting pyometra. But, I am also aware that trichomonads may exist in the genital tract of cows which show no clinical evidence for months or years and that these animals may breed normally and deliver live calves. I am uncertain, however, what proportion of herds are affected in this way, nor am I certain that all the losses ascribed to this disease are wholly due to trichomoniasis. It is by no means easy to demonstrate the parasite under the microscope and in the absence of confirmation of this nature, one hesitates to accept all the diagnoses made. On the other hand, it is very probable that it is present in many places where its existence is never suspected. A blood test and an intradermal test have been introduced but they do not always provide conclusive proof.

It almost appears that some other factor or factors must decide whether trichomonads shall exist in the genital tract of the cow without causing infertility or whether they shall become virulent. In the absence of precise knowledge it is difficult to speculate what the factor or factors may be, but a change in the *p*H of the secretions due to physiological causes, or the co-existence of some other type of infection, such as *C. pyogenes*, might provide a solution. Physiological causes might include ovarian dysfunction, resulting in relaxation of muscular and arterial tone of the uterus and vagina. I am greatly indebted to Dr. Muriel Robertson, of the Institute of Animal Pathology, Cambridge, for the following description of the disease. She writes :—

" Trichomonas infections may be transitory or may be very slight and may have a period of latency during which symptoms are not acute and the condition is at a sub-clinical level. The animals may have an almost normal pregnancy, with a healthy calf. . . . One can, nevertheless, not say that Trichomonas is an indifferent parasite, whose presence is of no account. There is, as this shows, a tendency to latent infections, which in self-contained herds carry on for some time, even a year or two, until it works up into an acute outbreak. Some of these latent infections seem to die out, but it is a common occurrence for protozoal parasitism to drop to a very low level, without entirely disappearing.

Trichomonas is not a normal inhabitant of the normal fertile animal but some degree of infection may exist with a successful pregnancy. It is, however, a separate entity and quite uncomplicated cases of *Trichomonas foetus* abortion undoubtedly occur. It is also true that secondary infections with a variety of organisms, such as staphylococci and corynebacteria can easily take place. Trichomonas is difficult to diagnose but not difficult to control when once it is clearly recognised. The trouble is that it is a true venereal disease and the bull transmits it to the cow and *vice versa*. The cow can be treated, but not the bull. I feel that diagnosis is often missed at present and the disease would be more easily treated if practitioners would get (*a*) a good idea of the nature of the disease and (*b*) the kind of history that reveals it and then (*c*) would conscientiously examine for it. The acute disease shows itself as a milky discharge, sometimes profuse (often not), with a return service in three or six weeks. Some of these animals settle later, without treatment, and these are the most dangerous spreaders of the acute disease to the bull. These animals may continue to return to service and may acquire secondary infections and may proceed to develop pyometra of greater or lesser degree. They often fall into a state of featureless sterility, very difficult to diagnose.

A less acute condition, which may gradually work up into the more acute, is only manifested by discharge, by vaginitis of a not very characteristic type and frequent return to service, which may in the end settle into a successful pregnancy.

Where early abortions (three weeks to four months) occur, with or without recorded discharge, and sterility is developed in the herd, microscopical examination of secretion from a large portion of the breeding herd is demanded. One infected animal gives the diagnosis. Insemination is a wise precaution or a fresh bull may be used. The point is that the whole herd is suspect, and the position must be faced. Negative findings do not make a ' clean ' animal ; positive blood tests are definite and make the position quite clear."

I will now read you extracts from a letter from Mr. L. E. Rowson, who has carried out a great deal of research in this disease. He writes :—

" I have felt for some time that the position is not so straightforward as one is led to believe. I have a feeling, though no definite proof, that the organism may be found as a normal inhabitant in many animals. Like you, I have had great difficulty in demonstrating the organism in outbreaks clinically typical of the condition, and I have also noticed that the ease of demonstration varies, even in the same animal, at different times.

In a number of outbreaks in the Midlands, the condition has been extremely difficult to clean up, using irrigations of iodine, etc., and swabs from these animals at a later date have usually revealed the presence of *C. pyogenes*. It seems possible in these cases that the latter organism was really the cause of the trouble, and that the trichomonads had multiplied, due perhaps to lowered resistance or, possibly, as you suggest, to a change in *p*H, for iodine in the strength used and with repeated irrigations, would certainly destroy trichomonads, but probably not *C. pyogenes*, and this would account for the condition failing to clear up.

Apart from these points, both Day, of Cambridge, and myself have noticed that trichomoniasis sometimes seems to appear spontaneously, without any possible history of contact with infection. . . . If it is a normal inhabitant of the vagina of certain cattle, one would naturally expect that conditions might at some time become suitable for multiplication. I feel that a careful examination of a number of normal fertile cattle may be of value."

In a personal communication from Mr. H. P. Standley, of Norwich, dated August 22nd, he states :—

" In our practices, we have not so far diagnosed the presence of trichomonas. We have had outbreaks of *Corynebacterium* infection of the uterus. This has appeared to be highly infectious, cows draining a lot of pus within a day or two of apparently normal calving. Treated with uterine irrigation, these cases have generally cleared up fairly rapidly."

Before I close this section on trichomonas as a cause of infertility, it would be only fair as well as instructive, to read you a further communication from Dr. Muriel Robertson, in which she chastises me soundly. She writes :—

" I am afraid I cannot let you get away with your packet of red herrings. I do not know what is your criterion of a ' perfectly normal genital tract ' or how you recognise it. I am convinced that cows with a perfectly normal *history* will be infected with trichomonas if sufficient numbers of healthy living trichomonads get into the right places.

There is a considerable degree of resistance, but you will admit that children often resist measles when exposed to infection, yet you would also agree that the human young, however healthy, are susceptible to this virus. The bull becomes infected right up to the epididymis, the semen may contain trichomonas and the organism can be transmitted by insemination. A bull can transmit the disease after an interval of eleven months, during which he has not given service.

You mention an unknown factor—there may be a hundred but you need not confuse yourself with them. If you can get practitioners really conscientiously to face trichomoniasis as a *venereal* infection with all its complications and to treat *every cow* that has been exposed, and further to recognise that the bull serving a trichomonas infected herd is a menace, you will stamp out the disease, and not otherwise. The idea that you can get away with the pious hypothesis that a normal cow (whatever that may be) will not take the infection and so on, is to obscure knowledge. Tuberculosis in man is another disease marked by latency, but you do not imagine you can control the disease except by treating it as an infection on its own basis.

The continuance of trichomoniasis is very largely due to the failure of practitioners to deal intelligently and consistently with *known* outbreaks. The selling of springing cows, served by infected bulls where the cow herself has had a trichomonas infection, without treatment, goes on unchecked. A practitioner finds an outbreak and treats all the empty cows and fails to treat the rest who are in calf to the infected bull after they have calved, etc., etc.

' Notions ' and ' ideas ' and the failure to think consistently in terms of the actiology of the disease are presented repeatedly in the advice given in practice about this infection. You will be doing a very good work if you will teach the diagnosis of the disease and the really consistent treatment of the infected herd with the elimination of the infected bull. Please forgive my insistence, but this is a perfectly controllable disease.

I do not know if the Fallopian tubes can become infected ; we do not think so at present. A state of anoestrum may follow upon an infection with trichomonas."

Well, as you will see, I have not come out of that correspondence unscathed, but any slight scars I may have sustained were worth while, for in these letters we have some really valuable information and suggestions. Emerging out of it all, stands out the possibility of introducing trichomonas infection into clean areas by the purchase of either bulls or in-calvers and also the fact that insemination from a bull with an unrecognised infection may cause widespread trouble. The question which arises is, How does one detect an infected bull ?

Cervicitis.—This condition is usually secondary to endometritis or vaginitis. The only point I wish to mention is that there is some evidence that a primary cervicitis may occasionally result from streptococcal infection, and that this type of cervicitis may be transmitted from bull to cow and *vice versa*.

Endometritis.—The incidence of endometritis has been estimafed by different observers as causing from 35 to 75 per cent. of all cases of infertility. The tendency lately has been to accept the lower estimate. The fact is that everything depends upon diagnosis and what we are prepared to accept as being true endometritis. The majority of cases occur as a sequel to abortion, and the incidence is far greater in the commercial herds of the Midlands and the North than in the more or less self-contained herds which we deal with in the South-West.

The modern view is that the great majority of enlarged, flabby

uteri met with in cows and unaccompanied by marked discharge, are not the result of endometritis at all, but are affected with hyperplasia, associated with physiological causes, ovarian dysfunction and or mineral deficiencies. As will be demonstrated later, calcium deficiency often contributes. In these cases there is, at any rate in the earlier stages, an absence of cervicitis and vaginitis and discharge is either slight or absent. The cervix is usually firm and rounded in the younger animals, and it is far more difficult to pass a uterine catheter through it than when endometritis is present accompanied by some degree of relaxation.

Endometritis, due to abortion disease, usually clears up in time even when untreated, provided that no attempt is made to serve the cow until she has gone past the time of her normal pregnancy. It may, however, require the next one or two abortion-free pregnancies to pass before the uterus becomes restored to completely normal functioning. The usual sequence, in my experience, is: Abortion—Retained membranes—Endometritis and infertility—Pregnancy—Retained membranes—Pregnancy after repeated services—Normal parturition. Occasionally the tendency to hold up the afterbirth may persist through several further parturitions.

Salpingitis.—In my experience, salpingitis is uncommon. One may examine a hundred uteri in the public abattoir, where a large number of infertile cows *still* end their days, without coming across anything which might be considered as a serious case of salpingitis. At least 75 per cent. of the cases encountered will be tuberculous, if submitted to careful examination, the disease having spread from the peritoneum with the formation of tuberculous nodules or adhesions, involving the bursa and Fallopian tubes. Possibly mild infections, apart from tuberculosis, may more often than we imagine be capable of rendering the tube dangerous to the safe passage of the fertilised ovum, without producing lesions which we can recognise by rectal palpation or even when we view the organs on the *post-mortem* table. But even mild cases, sooner or later, cause the appearance of adhesions between the walls of the bursal pouch, or, as often happens, the formation of fibrous cords running from the ovary to the wall of the bursa.

The chief organisms involved in ascending salpingitis are *B. coli*, *C. pyogenes*, streptococci and staphylococci and *Brucella abortus*. Salpingitis may follow abortion with septic metritis as a sequel, or it may be associated with trichomonas pyometra. On the whole, however, salpingitis must be regarded as a very rare sequel. It has been observed in connection with cystic ovaries.

The majority of cases of ascending salpingitis are evidenced by mild bursal adhesions with no evidence of metritis and no history to account for them.

The Physiological Aspects of Infertility

As a clinician discussing physiology, I am acutely conscious of the company in which I am mixing and I am mindful of the Chinese proverb, "When consorting with dragons, humility is no handicap." I wish to emphasise that the physiological mechanism—even in cows—is subject to many variations and to discuss the exceptions in the working of this mechanism would only confuse an audience. The picture I shall paint must be regarded only as "approximate." All the rest, regarding sterility, hangs around obtaining a fair conception of that mechanism. Workers in special fields tend to develop a "complex" which gives undue prominence to their own particular study, and a realisation of the physiological processes tends to prevent the observer deceiving himself into the belief that any *one* factor is of overwhelming importance in the causation of sterility.

I should like at this point to acknowledge with gratitude the very great amount of help I have received from Dr. J. T. Edwards in compiling these notes, both from written communications and from listening to the address which he presented to the Western Counties V.M.A. in August last, at their Exeter meeting. It was he who first pointed out to me the analogy between udder inflation in the treatment of milk fever and utero-vaginal irrigation in the relief of certain types of infertility. The similarity depends upon the benefit arising in each case from stimulation of the nervous system.

Just as in milk fever inflation of the udder *may* act reflexly on the hormonal control of the blood calcium, so stimulation of the sensory nerves to the uterus may affect the hormonal control of the reproductive system. The sexual cycle is undoubtedly mainly under the control of the pituitary, but our knowledge of the factors which control the pituitary is far from complete. Nervous stimulation does, however, undoubtedly play a part in certain species. Thus in the rabbit ovulation does not occur spontaneously but only some 12 to 18 hours after coitus. It seems that sensory impulses passing from the genitalia to the C.N.S. during coitus stimulate in some way the secretory cells of the anterior pituitary. There are also indications in other species that the discharge of gonadotrophic hormones is regulated by nervous reflexes, and it may well be that vaginal and uterine irrigations exert their action not as antiseptics destroying invading organisms but as irritants acting locally on the sensory nerve endings and bringing about reflex outpourings of gonadotrophic hormones leading to follicle formation and the induction of oestrus. If we irritate the utero-vaginal tract by massage with the hand or if we inject warm water, saline solution, lugol, or merely inflate the uterus with air, then the sensory nerves are stimulated and reflex secretion of gonadotrophic hormone ensues. In a roundabout manner we are producing just the same result as if we had injected gonadotrophic hormone hypodermically. In addition to this, suitable antiseptics may be capable of destroying any trichomonads with which they come into contact, although the stimulating effect on the sensory nerve endings may have a considerable influence, too, in increasing the resistance of the animal to these protozoan parasites. For it would appear that the normal healthy uterus which is experiencing regular oestrus cycles has great powers of resistance to infection. The uterus of the mare, for instance, nine days after parturition is capable of conception and the endometrium is already in a condition to permit of nidation of the embryo.

The hormone progesterone produced by the corpus luteum depresses the activity of the uterine muscle and inhibits ovulation. With degeneration or removal of the corpus luteum the uterus regains its normal contractility and regular oestrous cycles ensue. Now, when a corpus luteum persists for a long period the uterus remains relaxed, the blood flow becomes sluggish and a slight enlargement of the uterus similar to that existing in early pregnancy may occur. This is the stage of hyperplasia. This state of affairs may last a considerable time, with the cow in a condition of persistent anoestrus, but usually after a while the weakened defences permit the multiplication of bacterial flora present in the genital tract, and a mild type of endometritis may supervene. This endometritis is a purely secondary condition and will usually clear up readily with a return to the normal oestrous cycle. A similar condition of hyperplasia may occur with other types of ovarian dysfunction whenever the hormonal physiological routine is disturbed.

Normal reproduction depends on other factors besides hormones, and chief amongst these is the need for adequate supplies of vitamins and minerals. Of the latter, one of the most important is calcium and closely associated with this is vitamin D which helps to control calcium metabolism. This may in part explain the effect of sunlight, for the ultra-violet rays of the sun convert an inactive sterol present in the skin into an active antirachitic substance. Vitamin D, light and calcium are all essential to the proper functioning of the pituitary gland. A bull kept in a dark shed will become sterile. Sheep, transported from this country to another where the times of the seasons do not correspond with our own, breed during the period of greatest sunshine, whatever their breeding seasons may have been in their original home. Hens, kept in dark houses during the summer and given free range during the winter months, cease to lay in the warm weather and produce eggs during the winter, provided that food rich in calcium and vitamins is provided. Even electric light throughout the night in poultry houses will increase egg production. At first, it was believed that the increase in fertility was due to longer feeding hours, but the same results were obtained when food was withheld during the additional hours of lighting. Eggs produced from hens kept in darkened houses have a very low fertility ratio. In general, the results obtained in these experiments on birds apply to mammals also when we substitute ova in place of shelled eggs.

A result similar to that obtained from sunlight results from the administration of vitamin D in the form of cod liver oil. In addition, the vitamin A content guarantees healthy function of the epithelium of the seminiferous tubules of the male.

Vitamin E, the anti-sterility vitamin, is also necessary for normal pregnancy in some species. Lack of this vitamin results in imperfect nidation of the embryo and possibly in pyometra. The action of the vitamin B complex is not yet well understood. All the above are under the influence of (*a*) domestication and hereditary influences, (*b*) environment.

(*a*) *Domestication.*—In a state of domestication cows are bred at seasons unsuitable to their physiological requirements. They produce abnormal quantities of milk and live on an unnatural diet. Their endocrine systems are overburdened, not only owing to the conditions under which they exist, but also because they are subjected to the strain of selective breeding, carried out for some special purpose, such as milk or beef production or, as happens in some countries, for working purposes. . Special mutations may result in the introduction of lethal factors.

(*b*) *Environment.*—In domestication natural enemies are reduced and more time can be spared for breeding and feeding. This is more than compensated for by intensification of infection. Thus, tuberculosis, rare in wild cattle, is rampant in those housed throughout a portion of the year. According to J. T. Edwards, 25 per cent. of tuberculous cows in some localities suffer from tuberculous metritis. Brucella infection is spread by confinement on small areas of land, paving the way for infection by bacteria, protozoa (trichomonads) and viruses, such as that of granular vaginitis. Soil and climate

cannot be dissociated. For all practical purposes they must be regarded as one. Soil is a composite "living whole," mainly influenced by climate. Mere chemical analysis gives very little indication as to soil potentiality. Thus, the total lime content as shown by the chemist may not represent available lime, and again an excess of available lime may diminish the availability of existing elements, such as manganese and boron.

Domestication limits the power of the animal to seek more suitable soil, hence good animal management and husbandry must be directed towards limiting this disability. The capacity of breed types to adapt themselves to changes in soil and climate environment is limited. This is where native breeds, such as Ayrshires and Kerries, have an advantage over imported breeds in that they can exist under the conditions present and have no longer to mark time during a process of adaptation.

I should like at this point to quote you some extracts from an article by Viscount Lymington which appeared in *The Farmers' Weekly* of July 17th, 1942, under the heading: "Man and Soil in Harmony." He writes:—

"A sound crop rotation which fulfils the needs of the soil and organic fertilisation of the soil, presupposes a healthy balance of animals thereon. Although, in the East, the main livestock supplying fertility has been human beings, western appetite and western sewage systems mean that the animal balance of our farms must come mostly from the familiar domestic livestock—cattle, sheep, pigs, and poultry. Lately, the trend of our industrial civilisation has been to turn animals into factories—pipe-lines for producing bulked and murky milk; conveyor belts for an endless chain of eggs, sausages and so on. We have too rarely looked upon them as healthy and harmonious units in the function of soil ecology. Our greatest livestock 'industry' (the very word shows the falsity of our conception) has centred around milk. Let us consider the atrocities we have perpetrated on the innocent bovine as an example.

The cow breeds naturally in the spring, produces enough milk to feed her calf—some two or three hundred gallons; she does this in sunlight, on the most perfect of Nature's food, *i.e.*, spring and summer grass. She also stores up her energy then to carry her and another calf through the following winter. For the last forty years we have insisted on her calving down in autumn and winter; we feed her with hay and straw and make her stomach groan with the addition of exotic by-products of industry to force from her, at the wrong time of the year, three, four, and even ten times the amount of milk which Nature demanded of her. We have bred for milk records too often in disregard of stamina. Our future breeders are mostly winter-born calves, weaned at birth and nourished at best, for a short period on the bucket; at worst, on a series of ersatz foods.

We house the cow on cold concrete, devised in unconscious collaboration between the Devil and the Ministry of Health, while we turn her liquid manure, together with disinfectant fluid down the drain and cast her mouldy, ill-digested droppings in amorphous, long-strawed lumps on the fields nearest the homestead. The machine-raped milk robs the land on which she has to feed of the organic phosphates and other virtues which would normally be returned to it. This land becomes cow-sick."

When one treats a great number of cases of infertility, one cannot help noticing that a considerable proportion show no evidence of abnormality or disease. Quite frequently, this applies to a number of animals in a herd. If one enquires into their breeding history and finds that there has been no contagious abortion in the last few years and no history of trichomonas, some other cause will have to be sought. Probably, one will find that the oestrous cycle is fairly regular or perhaps there is a tendency towards anoestrus. In the end, the conclusion one is apt to arrive at is that there is nothing that one can find wrong with the animals excepting that they fail to breed. By this time one will have enquired into the breeding history of the bull and made every possible investigation into the matter of his fertility, but in most cases it will turn out that the owner has anticipated you in this matter and by now has tried out all the bulls within ten miles of the farm, with no better success. I do not doubt that you have all met with this type of case. It is certain that you will have done so if your herds include a large proportion of Channel Island or other breeds, giving high yields containing a large percentage of butter fat, associated with a more or less persistent hypo-calcaemia. I am not attempting to give you a definite cause for this type of sterility, because a cut-and-dried diagnosis is usually as worthless as a cut-and-dried line of treatment, but I propose to discuss, briefly, a few of the factors which may contribute.

In *The Veterinary Record* of June 6th, 1942, I published some notes on "Infertility in Guernsey Cattle," in which I pointed out that abnormally high lactation in the S.W. of England is often associated with a mineral deficiency and that it evidences itself in various types of ovarian dysfunction. The principal abnormalities observed were:—

(1) Failure to develop follicles (anoestrus).

(2) Failure to ovulate, in spite of the presence of a follicle.

(3) Abnormalities of the corpus luteum, including persistence and cyst formation, resulting in hyperplasia of the uterus, with oedema of the endometrium.

(4) Defects in the "timing" of the oestrous cycle, resulting in the development of a ripe follicle, side by side with an active corpus luteum, which had failed to regress.

(5) Delayed or late ovulation.

(6) Cystic ovaries and conditions associated, such as hydrosalpinx and cystic conditions of the endometrium. These are comparatively rare.

Now, any of these conditions may account for cases of functional infertility, either in individuals or in herds, but there are many other factors to be considered in the causation of a low breeding index in general. Starting from the beginning, let us first consider the calf, its heritage, its parentage and its early upbringing.

The young animal may start life at a disadvantage, for it is reasonably certain that in certain circumstances a tendency to infertility may be transmitted from either sire or dam to the offspring. W. L. Williams found that heifer calves born after long periods of infertility in the herd were often infertile when they reached maturity, even if they changed hands and were maintained under identical conditions with other heifers displaying normal fertility. I have myself recognised families in which functional infertility had shown a marked tendency to crop up throughout numerous generations. In these, the average number of services required to achieve pregnancy had been abnormally high. R. L. Conklin, speaking at the 11th International Congress, recorded the presence of sterility and allied genital diseases among families, in the herds studied. Some families exhibited sterility through each generation, until the family was eventually eliminated. Other strains of the same breed may be exposed to identical conditions of housing, nutrition and management, without exhibiting any tendency to sterility among the progeny. Sires which have come from families showing this predisposition have been found to be of low productive power.

A somewhat similar condition occurs in bitches, in which all the female puppies which survive and reach adult life lose the majority of their puppies during the first few days following birth. The defect is carried on in the female line until the strain becomes extinct. Although streptococcal infection has been blamed as the cause, this must be considered possible but not invariable. It would be of interest if bacteriological examination could be carried out in cows which habitually lose their calves shortly after birth.

Low viability of the ovum is seldom given due consideration, but there is reason to suppose it may be a transmissible feature. Many cows and heifers which come into season at slightly irregular periods may well represent cases in which the ovum is actually fertilised, but dies shortly after implantation in the mucosa.

Death of the foetus between the sixth and ninth months of pregnancy, followed by abortion or retention of the foetus (occasionally with the development of pyometra) with no ascertainable cause, is becoming more and more common in Guernsey cattle. In these cases brucellosis and trichomoniasis have been ruled out by suitable examination, but the possibility of a deficiency of vitamin E has sometimes been suspected. W. L. Williams blames inbreeding as a cause of impaired fertility and has recorded sterility among inbred cows as the result of impaired structural development. The bull may also transmit a low fertility ratio to the heifers bred from him. Williams also pointed out that abnormal gestation periods were transmitted in the female line and that bulls born of these females could transmit such abnormalities of the gestation period to the heifers which they sired.

Factors which prevent a heifer calf developing into a normal fertile heifer include disease, environment and nutrition. White scour, navel ill and pneumonia in the young animal may influence future fertility, as also may lack of exercise and light during calfhood. The endocrine glands are dependent upon the same factors for their normal development as the remainder of the body. Calves born in early spring and permitted exercise and grazing outdoors during the summer months, come into oestrus at an earlier age than calves born in the autumn and housed all the winter. Good nutrition in the calf necessitates the provision of a milk diet for at least the first two months of life. Artificial and war-time feeding may preserve life, but we have yet to see the influence of this treatment upon the future fertility of the dairy stock. I believe that the fertility expert of the future will be kept well occupied, but it will require all his resources to overcome the effects of early starvation in his patients.

When the calf has survived all these possible catastrophes, and has grown into a lactating cow, she is faced with a number of fresh obstacles to her sexual career. She may have been handicapped by an abnormally high milk yield, necessitating an increased output of lactogenic hormone and a considerable wastage of mineral salts, eliminated in her milk. It may be that her udder has outgrown her pituitary and that her powers of digestion and assimilation, not only of food materials but also of minerals, have been weakened as the result of selective breeding. It must be recognised that dairy farming robs the soil in contrast to what happens on a beef farm, where a far greater proportion of the minerals ingested are returned to the soil in the form of dung. In dairying the yield is milk, rich in minerals, none of which go back to the land but pass into the human interior, after which, in western lands, they go to waste.

Modern ley farming involves the ploughing-in of turf, carrying within it the accumulated droppings of generations of cattle. The first green crops cut from this land should be excellent, but unless the pastures are *soon* permitted to revert to grazing, future crops will become deficient in essential minerals. In my own county, large

areas of grassland are ploughed and planted in broccoli. After the land has ceased to be profitable for this purpose, it is again laid down in grass. It takes from five to seven years to restore the fertility of land so treated, and an exactly similar period to restore the fertility of the cows forced to graze upon it. No amount of uterine irrigation or ovary squeezing will meet with any success in such cases.

The pituitary gland, that most overworked portion of the cow's anatomy, was designated by Zondek, "the motor of the ovary." (*Vet. Bull.*, Sept., 1942). It is encased in an unstretchable bony box, with no room for expansion. It regulates growth, influences carbohydrate metabolism and the production of ketones and has a controlling influence over the thyroid, parathyroid and suprarenal glands. Whilst it is perfectly capable of dealing with normal loads, it is liable to break down when called upon to regulate the sexual life of a freak animal.

The output of the pituitary is regulated in part by the influence of the nervous system, but it is dependent for its nutrition and functioning upon the quality of the blood flowing through it. The presence in this blood of the correct proportions and amounts of certain mineral salts is essential, just as much as their presence is essential if neuro-muscular tone is to be maintained.

Anoestrus is usually the first indication of mineral deficiency and may be observed with marked regularity in heifers which have wintered badly. Hart, in California, found many years ago that in white rats under-nutrition stopped the oestrous cycle. Low protein and low phosphorus stop or lengthen it in exactly the same way as a wide calcium/phosphorus ratio does. In range cattle a distinct lowering of the inorganic phosphorus has been found to be associated with functional infertility. Crews, a range cattleman in Texas, found that the calf crop was greatly increased when he fed 350 lb. of cotton seed cake, per head, per annum. Cotton seed is rich in protein, phosphorus and fat. He also found when he fed 21 lb. per day for 30 days before and after calving that 50 per cent. of the fresh cows came into oestrus during the first 30 days following upon parturition and conceived upon service.

Forbes showed in 1925 that 1 gramme of calcium is given up from the cow's body for every kilogram of milk produced, but that under the most favourable circumstances only 15 per cent. of this amount can be assimilated. The drain upon the skeletal calcium in a cow which milks throughout eleven months of the year must be enormous. Unsterilised bone meal, from an anthrax-free source, is far better than sterilised bone meal for replacing minerals and may be fed together with cotton cake, when the latter is available. Cod liver oil should be supplied to provide the vitamins necessary for proper calcium assimilation.

Trace minerals play an important part. Manganese is one of these and as has been pointed out by the Survey Committee, heavy liming of old pastures may fix it in the soil and prevent its assimilation, with infertility as a result. Taking all in all, the Ca/P ratio must be regarded as the key-pin of bovine metabolism.

The influence of food upon fertility depends not only upon its composition, but upon a sufficiency of variety and upon its place of origin. The feeding of one particular grain over a long period without admixture of other foods is a sure way of inducing infertility. Before the war, maize and cooked maize products afforded a striking example of this. I have no doubt that home-grown grain may be superior to imported grain but I have very much doubt as to whether corn grown on our local dairy farms, which have been depleted of minerals for years, will improve the fertility of our herds. Corn should be ground for use as required. Stale ground corn is inferior both on the score of vitamin content and digestibility.

I will not delay you any further in this matter of sex physiology except to emphasise the point that the great healer in most cases of infertility is Time. In the past we have usually dealt with our cases after the farmer has tired of taking his cows to the bull, and we enjoyed the advantage that the time of their natural recovery was drawing ever nearer. Henceforth, if the Survey Scheme comes into general operation, veterinary surgeons will deal with their cases much earlier. I hope they will not be disappointed if it takes them much longer than formerly to effect their "cures."

Before passing on to the subject of treatment, I must say a few words regarding the influence of the bull.

Although it is not intended that this paper shall discuss infertility in the bull, one cannot overlook the fact that the male, even when apparently normal in service, may yet fail to emit semen, or he may produce semen of low viability. He may also transmit contagious genital diseases which he may have acquired, or he may act as a mechanical carrier of infection without showing any clinical signs of disease himself. The danger is great when using communal bulls. Any cow exhibiting the least vaginal discharge should be rejected. A record of services should be kept and any cow which does not return at approximately 21 days should be examined for trichomoniasis or other infection before being accepted for further service.

The sheath of the bull should be irrigated after each service with a dilute solution of hypochlorite or other harmless antiseptic and the preputial hairs should be washed in the same solution. Trichomonas infection can be carried by the bull without any external evidence and diagnosis is exceedingly difficult. As the parasites may be carried in the semen and there is no known method of destroying them, widespread damage may be done before such an animal is suspected. N. J. Scorgie, speaking to the Royal Society of Medicine (April 5th, 1942) discussed the possibility recorded by American workers, of inability of the bull to synthetise all the vitamin C needed for normal functions. When no cause for poor quality semen can be discovered, one may try the effect of bi-weekly injections of 1 to 12 grammes of ascorbic acid over a period of five to six weeks.

The viability of the sperm varies enormously in the same bull from time to time and even from different services on the same day. When sperm has been stored for any length of time in the seminal vesicles, it becomes contaminated with dead and disintegrating spermatozoa and the *p*H may be altered. Semen from a second service, an hour later, may be far richer in sound, actively motile sperms.

The age of the bull and bodily condition, taken together with general management, have a considerable effect upon its breeding powers. Kept in a dark house with plenty of food, he becomes sterile; grazed for a few weeks on poor pasture where he has to exercise in order to exist, he may regain his potency.

Treatment of Infertility

We now pass on to the treatment of infertility in the cow. As I stated earlier in my paper, the most unsatisfactory chapter in our knowledge regarding infertility is the one devoted to treatment. I do not think that the most enthusiastic exponent, if he were perfectly honest and critical, could claim to be satisfied with his own handiwork in this respect, particularly if he included in his records those cases which have recovered in spite of, rather than because of, treatment. One of the great disadvantages of treating cases on the farm is that one cannot use controls.

If we summarise the causes of infertility which we have discussed we find that they fall into the following categories:—

(1) Endometritis, resulting from infection of the post-parturient uterus and its membranes; frequently associated with brucella infection, less often with trichomonas.
(2) Tuberculous metritis.
(3) Vaginitis from infection.
(4) Uterine hyperplasia frequently with
(5) Ovarian dysfunction, often due to mineral deficiency.
(6) Salpingitis—rare.
(7) Lack of nutrition or assimilation.
(8) Last, but by no means least, lack of tone of the autonomic nervous system.

Now let us consider the armament with which we propose to combat these conditions:—

(1) Utero-vaginal stimulation or, in other words, reflex stimulation, induced by massage, the injection of fluids, air or irritant injections into the uterus or the anterior vagina.
(2) Expression of the corpus luteum with the object of inducing oestrus.
(3) The injection of gonadotrophic hormones and oestrus-inducing substances.
(4) The administration of substances which directly stimulate the parasympathetic system.
(5) Suitable nutrition, including the provision of minerals and vitamins.
(6) The improvement of pasturage.
(7) Cross-breeding or the occasional use of a sire bred for stamina, rather than for milk production.
(8) Shortening the lactation period and providing a longer "dry" period before calving.
(9) The provision of sunlight and carotene.
(10) Artificial insemination.

Now let us briefly discuss these in order:—

(1) *Utero-vaginal Irrigation.*—The generally accepted method is the injection of a solution of iodine in potassium iodide, with a final strength of 1:1,000 or 1:2,000. Not more than three ounces should be injected into heifers and from four to six ounces into cows, according to the size of the uterus. Excess of fluid injection may easily lead to uterine rupture. It may not be a wise proceeding, at any time, to irrigate the uterus of a maiden heifer.

I am not at all sure that, in order to produce results, it is necessary to introduce the catheter through the os and in any case, where considerable difficulty is experienced owing to constriction of the cervix, I advise irrigating the anterior vagina and leaving the uterus alone. I realise that this sounds like heresy, but it is sound practice and may save many lives. During 1940 I treated 100 cows by vaginal irrigation and a further 100 by uterine irrigation, keeping records. By some curious chance, the percentage of so-called "cures" was slightly higher in the group treated by vaginal irrigation

only. It must be remembered that the anterior vagina in its upper aspect, that is to say at its roof, is the most sensitive portion of the genital tract and palpation of this area will always induce heavy and prolonged straining. Stimulation of this area may therefore have the same reflex effects as uterine irrigation.

Actually, iodine solutions may not be quite the best medium for injection as iodine destroys surface cells and possesses very little penetrating antiseptic action in the strength employed.

The ideal injection is pure glycerine, not now obtainable. Next comes a 10 to 20 per cent. sugar solution, boiled, and then a 2 to 5 per cent. solution of common salt. Recently an extract of juniper has been recommended.

Massage of the uterus by hand and the irritation set up by a soapy hand introduced into the anterior vagina, probably act in a similar manner to injection. Frequent repetition of massage is needed to produce results.

The whole idea is to induce stimulation of the local nerve-endings, resulting in a reflex stimulation of the pituitary with an increase in the output of gonadotrophic hormones.

(2) *Expression of the Corpus Luteum.*—The advantages and disadvantages of this operation have already been discussed. Where retention persists, calcium and vitamins A and D should be supplied, and follicle-stimulating hormone should be injected at weekly intervals until oestrus results.

(3) *Gonadotrophic and Oestrogenic Hormones.*—Prolan A, antuitrin S, stilboestrol, and many other preparations on the market may be made use of. Prolan takes longer to induce oestrus than stilboestrol, but it is a true follicle-stimulating hormone and, in theory at least, there should be a greater chance of securing true ovulation by its use than by the employment of stilboestrol. The latter induces symptoms resembling oestrus in two or three days, but it would not be reasonable to expect an inactive or atrophied ovary to develop a follicle to the stage of ripening and bursting in such a short time. True ovulation is more likely to occur at the next naturally occurring oestrus, although in my own experience there may not be a succeeding oestrus, or one may not occur for several months. On the whole, my attempts at producing fertile oestrus with the help of stilboestrol have been disappointing. Pregnant mare's serum is recommended but, so far, I have had little experience of its use. It is important before using this agent to ascertain that true anoestrus exists, that the C.L. present is not associated with pregnancy, also that a follicle is not developing, otherwise one may produce cyst formation.

Ovulation in the cow should occur within 24 hours following service and it is always well to defer service as long as possible or to give a second service when the cow is just about to go off oestrus. Two services are an advantage also in bulls which are underworked, the second emission in such cases being often richer in viable sperms than the first. It is a practice among farmers in my own county to serve cows with an unmilked udder. I think there is more than superstition in this theory. It was also the custom in my young days to give cows suffering from anoestrus the milk of a " bulling " cow and the same treatment was given to gilts which failed to come into service. How far these efforts were successful, I do not know. I am afraid I was too young at the time to take sufficient interest in matters of sex ! " Shy " bullers or cows affected with silent heats, are a problem. Stilboestrol injected two days before the expected heat will usually cause the cow to accept service. I presume that this condition corresponds with the so-called " frigidity " in the human female.

(4) *Substances which stimulate the parasympathetics* may be tried. Carbamylcholine, in small doses, may be repeated daily either by mouth or by hypodermic injection. Strychnine may be added to increase the action, if desired. This is a line of treatment which might be tried out more fully.

(5) *Suitable nutrition* is not easy to provide in these days ; we can only do our best with the materials at hand. Nevertheless, good husbandry can improve grazing land and increase its mineral content. One may add to the diet mixtures containing bone meal, iron and copper, magnesium and manganese mixed with common salt. Cod liver oil may be introduced into the ration, commencing with very small doses at first and working up to two ounces per head daily.

Copper sulphate in reasonably large repeated doses appears to exert an almost specific action in certain types of endometritis and vaginitis.

Hyperplasia of the uterus is readily overcome, providing that one can induce a state of oestrus and bring about a repetition at short intervals. Cows which exhibit hyperplasia in spite of the fact that normal oestrus occurs, are benefited by inducing artificial oestrus in the middle of the normal oestrus cycle. Uterine irrigation is a useful adjunct to treatment in these cases, and the best results appear to follow injections of sugar solution. Stilboestrol sensitises the uterine muscle to the action of pituitrin. Under the influence of oestrus and gonadotrophic hormones secreted at this time, regression of the retained C.L. usually follows.

(10) *Artificial insemination* may be useful to avoid transmission of disease mechanically from cow to cow, by the penis of the bull. It is dangerous if there is any fear of the bull carrying trichomonas as it may be transmitted in semen, but it may prevent spread of infection if a clean bull is purchased and isolated from the herd. The value of insemination in brucellosis is open to doubt. It is never of any avail unless the cow is sexually healthy.

Ovarian dysfunction can be treated by sexual rest and the administration of mineral salts, notably calcium. Given rest, the majority of these cases recover in time.

It is essential before commencing treatment to distinguish between a specific infection and a physiological upset and to regulate the treatment accordingly. Diagnosis is not easy, treatment often less so. The economic aspect should be considered carefully. Cows are often offered for treatment after they have been milking many months and the owner's attempts to overcome the infertility have failed. Such animals, if in good condition and of no special value, should be butchered, otherwise they become passengers for twelve months at least. Cut-and-dried treatments, in the past, have helped to eliminate careful diagnosis. The most hopeful of all treatments is sexual rest.

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The discussion on the foregoing paper was opened by Mr. J. W. Burgess, Edinburgh, and Mr. T. N. Gold, Redditch ; Messrs. H. M. Wilson, A. Wilson Taylor, P. G. Miller, Dr. H. H. Holman and Mr. D. McFarlane also participating.

Reply to Discussion

Mr. R. H. Smythe, in reply, said that he agreed with Mr. Burgess that little could be learnt concerning sterility in a few hours' tuition apart from that little learning which they had been told was a dangerous thing. He had no intention of being hard on the young graduates, he merely wished to put on the brake a little and to warn them not to let enthusiasm run away with common sense. Everything which the older school believed in was not necessarily wrong, nor were all the new theories necessarily right. It was good sometimes to stop working, sit down and think whether we were really doing good or harm or were we merely working because we thought we ought to do *something*.

He knew practitioners who had always treated sterility with powders administered in the food. The supply lasted quite a while and the label stated that the cow must not be served before all the powders had been administered. These powders bore a very good reputation. They certainly gave the cow a rest and therein lay the secret. They were perhaps not so modern in theory as the treatment supplied by a gipsy many years ago. His treatment consisted in the insertion of a plug of tobacco into the anterior vagina. He was a pioneer in the use of irritants to stimulate the nervous system and the output of oestrogenic hormones but an unsympathetic bench condemned him to gaol !

Mr. Burgess appeared to be surprised at his suggestion that vaginal irrigation might be as effective as uterine irrigation. Personally, he believed that it was equally good but there was always a question as to how much good was effected by either. Without some efficient controls, the whole thing was merely speculative and there was undoubtedly a lot of wishful thinking. Mr. Burgess was also surprised that he did not advocate uterine irrigation in maiden heifers and he could only reply that he considered that in immature animals this was equivalent to any other type of " rape " and should be punished in the same way. His preference for sugar or glycerine to iodine for irrigation purposes lay in the power which these substances possessed to induce a flow of lymph. Iodine solution in the strength employed was an irritant but had little penetrating antiseptic value.

He thanked Mr. Gold for his very useful contribution and he was very interested to hear that he had at last lost a cow from ovarian haemorrhage. Mr. Gold did not appear to have very great respect for the essayist's opinions but at least he would in future have to realise that expression of the corpus luteum was not free from risk. He was sorry that Mr. Gold had not noticed that the uterus contracted when stroked. He could only suggest that his technique was at fault or that he was squeamish. It was a generally known fact. He could not agree with Mr. Gold that hyperplasia was only associated with retained corpus luteum ; other types of ovarian dysfunction were often responsible.

The agglutination test for trichomoniasis was introduced by W. R. Kerr and Dr. Muriel Robertson and was described by them in *The Veterinary Journal* of November, 1941.

He did not believe that the injection of a small quantity of iodine solution into a gallon of pus did pyometra cases any good. Stilboestrol, followed by pituitrin, drained off a great deal of this and irrigation might then be more usefully employed. It was in cases of this type that he had obtained apparently good results by administering drachm doses of cupri. sulphas twice daily for a week. He had *not* suggested inflating the cow's udder for the treatment of infertility but there would be no harm in trying it, with due asepsis. It would not be much more silly than a good many of the things they did already.

He agreed with Mr. Gold that it was far nicer treating cows in March or April than in winter. Evidently Mr. Gold also agreed with the essayist that green grass was more useful than squeezing ovaries. Regarding Mr. Gold's remarks on his agricultural policy, he was still not convinced that pulling as many crops as possible out of the land would have a beneficial influence on the stock which lived on them. Liming the land was beneficial because it grew better herbage on sour land rather than because of its influence in raising the blood calcium.

CLINICAL COMMUNICATIONS

Paraffin Poisoning in Cattle

G. EATON, M.R.C.V.S.
HALLATON, MARKET HARBOROUGH

The following two cases, which are unique in my own personal experience, may interest you. On the afternoon of September 16th I was called to see a 3½-year-old Shorthorn heifer calved about two months. She was stated to have been taken ill suddenly and was regurgitating stomach contents down her nostrils. Before I could get to see her I received another message to say that she was dead. In view of the very sudden onset of symptoms a blood smear was taken, but it was negative for anthrax.

The next afternoon I received another message stating that a three-year-old bullock out of the same lot was ailing. This on examination showed marked excitement and wildness, almost amounting to frenzy, blindness and inco-ordination of movement, and the breath literally reeked of paraffin and could be smelt several yards away. I then learned for the first time that about an hour before the heifer was taken ill 35 gallons of paraffin had been delivered to the farm for use as tractor fuel. The bulk had been put in tanks, but several gallons were placed in an open galvanised trough. The cattle, I was then informed, were about half a mile from a drinking place, and even there water was very difficult to get at, so they were apparently very thirsty. Evidently the heifer drank a large amount of paraffin, certainly not less than a gallon straight off, with rapidly fatal results. The bullock which had a smaller quantity lingered for 36 hours and then collapsed and died. I had not the opportunity of making a *post-mortem* examination on either carcase, but the knacker informed me that the stomach contents of both animals reeked of paraffin.

Prior to seeing these two cases I would not have believed that cattle would have drunk enough paraffin voluntarily to produce fatal results. I am aware, of course, that paraffin is frequently given in smaller doses to cattle by the dealing fraternity to stop Johne's disease cases from scouring before sale.

* * * * *

Diffuse Lymphoid Leukosis of the Skin in a Dairy Cow

J. L. LINZELL†
ROYAL VETERINARY COLLEGE

The following unusual condition was found *post-mortem* in a cow and the history of the beast subsequently obtained from the owner.

Subject.—Black cow with Kerry type of horns, out of a half-breed Kerry by a Shorthorn bull. Aged 6½ years. Dry.

History.—One of a dual purpose self-contained Shorthorn herd, built up because of an outbreak of contagious abortion in 1935. The beast was a good dairy cow and produced two steers and a heifer. It was in good condition until March, 1942, when the owner noticed that the hide was becoming rough and dry. This became worse and the flies seriously irritated the cow. She was dressed twice with colza oil, sulphur and spirits of tar with some success, but the condition persisted and the beast was slaughtered on August 5th, 1942. There were no systemic symptoms. The cows lie out day and night.

Post-mortem Examination.—The carcase was that of a cow in fair condition. The skin was very rough and raw in places, especially those parts exposed to rubbing. It was very sparsely covered with hair and in places quite bald. When the skin was removed it was found to be uniformly thickened over the whole body surface, being about ¾-in. thick. It was exceedingly tough and the whole hide weighed 189 lb. (normal weight 70 lb.). The prescapular and precural lymph glands on each side were greatly enlarged each being as big as a man's foot and one weighed 4½ lb. The consistency was normal. All other lymph glands throughout the body were macroscopically normal, as were all the viscera. There was no abnormality of the spleen or liver, so far as could be seen with the naked eye. Unfortunately blood films were not made and the bone marrow was not examined.

Microscopic examination of sections of the skin and enlarged lymph glands was made. The increase in size was in each case due to an infiltration of round cells. These varied in size and resembled small, medium and large lymphocytes, the former two being the most numerous. The papillary layer of the dermis was massively infiltrated and this resulted in the thickening of the skin. The deeper reticular layer was not heavily infiltrated. The epidermis was eroded in places and some lymphocyte-like cells were seen in between the epidermal cells. Just below the epidermis a few cords of similar cells were seen growing perpendicularly to the skin surface. Only a few hair follicles, erectile muscles and sweat glands were seen and these were widely separated by the extensive cellular infiltration. The normal appearance of the lymph glands was almost completely obscured and the distribution of the infiltrating cells was fairly even. Occasional lymph-sinuses were seen in parts and there were some germinal centres in the cortical area. A few mitoses were seen in the skin and lymph glands and blood as seen in section of blood vessels appeared normal. Up to the present no other animals on this farm have been affected in the same way.

This condition appears to be a form of lymphatic leukosis, but whether leukaemic or aleukaemic is not known. Although not proved microscopically it appeared to be limited to the skin and associated glands and was, therefore, deemed worthy of record. A limited search of the literature has failed to reveal any reference to a similar condition in animals, but in man in leukaemic lymphoma there is occasionally a diffuse and universal skin infiltration and the skin may be locally affected in Hodgkin's disease. (Ewing: Neoplastic Diseases. 1934.)

* Presented to the meeting of the Lincolnshire and District Division, N.V.M.A., held at Peterborough, October 29th, 1942.

† Final year student.

Mr. Gold thought that conditions in Cornwall must be different from conditions in Worcestershire and he was perfectly correct. The cows in the latter county were very working-class, of doubtful parentage. Those in Cornwall traced their ancestry back for many generations. Social grades enjoyed separate social diseases and required different handling. The diseases of commercial herds were mainly due to infection, those of the better-class herds were more often physiological.

Mr. Wilson asked about manganese deficiency. Little was known about it. Manganese was a very important element in crop production and its deficiency in soil caused various plant diseases. It was possible that lack might affect breeding also. The amount available in soil might be rendered inassimilable by recent heavy liming of the land. Trace elements might be found to be very important in breeding. He thought that infertility might be largely seasonal and that many cases righted themselves when favourable conditions returned. Mr. Wilson Taylor asked about the incidence of infertility in range cattle. On the Cornish moors, where cattle ran wild, the fertility ratio was high.

He did not agree with Mr. Miller that the catheter should be inserted into each horn separately. If the tip of the catheter passed through the internal os and was retained in that position, both horns would receive the injected fluid.

Dr. Holman regretted that the essayist deprecated over-civilisation in the cowshed he argued that humans were compelled to sit figuring on city stools and that advance in all things was essential. It was hardly likely that either party would be happier if the positions were reversed; in any case, two wrongs never made a right. He still maintained that what Dr. Holman called "progress" on the part of the cow, would ultimately result in her extinction.

The changes in the endometrium in cows and humans did not correspond exactly and it would be difficult to obtain specimens of mucosa in the cow. He was not aware that any work had been done on this subject. One could trace the progress of ovulation in the cow by palpation of the ovaries, but fortunately this was impossible in the case of the human female.

ABSTRACT

[STUDIES WITH EQUINE STREPTOCOCCI. III—VACCINATION AGAINST STRANGLES. BAZELEY, P. L. (1942.) *Aust. Vet. J.* **18.** 141-155.]

Attempts to produce a satisfactory vaccine for use in the prevention of strangles by treating strangles streptococci in various ways have in the past met with disappointing results. A preliminary trial of various vaccines in army camps suggested to the author that young culture organisms cautiously killed by a short exposure to a moderate heat might provide a satisfactory immunising agent. Accordingly, an extensive second field trial was carried out, involving the vaccination of over half of upwards of 4 000 horses. Strangles, as evidenced by the development of definite abscesses in the submaxillary region or elsewhere, which, when opened gave typical strangles pus, was four times as frequent in the non-vaccinated as in the vaccinated group; analysis of the results obtained showed that the degree of protection conferred was statistically significant.

The method of preparation of the vaccine, and its application in the field, are described in great detail. One interesting feature was that the strain of *Str. equi* used was almost certainly free from any possible strangles virus. The results obtained are cautiously estimated, but the author feels that a definite advance has been made in tackling the immunological problem of strangles.

E. C.

A British Friesian cow and her week-old heifer calf fetched 215 guineas at Carmarthen and a pedigree Shorthorn cow 190 guineas—record prices for South Wales.

REVIEW

[THE NEWER KNOWLEDGE OF NUTRITION. By E. V. McCollum, E. Orent-Keiles and H. G. Day. Published by the McMillan Co., New York. Price 21s.]

For a scientific book to reach a fifth edition is in itself a recommendation, especially so when it deals with a subject so much in the public eye as nutrition. The earlier editions of this book were for long regarded as among the leading publications on the subject in the U.S.A., for Prof. McCollum has himself largely contributed to modern concepts of the fundamental biochemical bases of nutrition, but it went out of print about 1935. The present edition has been largely rewritten in an endeavour, as the authors point out, to include all essential information about each nutrient, to prepare a concise survey of the field of nutrition more extensive than others now available, and to determine what is sound information and what is speculation in respect of the nutritional needs of various species including man: it sets out to discuss the dietary properties of foodstuffs, the characterisation and occurrence of malnutrition in man and animals and the means of dealing with these nutritional problems.

From the above it will readily be concluded that the reviewer has no easy task. There are some 684 pages, including about 50 pages of tabular matter and illustrations. Each chapter has appended to it a list of references to the more outstanding research papers on the subject matter dealt with, so that those who wish to read more deeply obtain guidance.

To give the reader some idea of the scope of the book it may be mentioned that a historical review occupies two chapters of some 30 pages; proximate principles, four chapters of 120 pages; minerals and trace elements, five chapters of 125 pages; vitamins, 12 chapters of 240 pages and the remaining chapters on dietary properties, appetite, dietary habits of man in different parts of the world, diet and teeth, health, longevity and so on fill some 100 pages or so.

It becomes of interest to consider how far the authors' attempt is achieved. It can be said without fear of contradiction that, in so far as man is concerned, the authors have completed a tremendous task admirably. They have produced an exhaustive and authoritative account of the complex subject of nutrition which is easy to read and the arguments of which are readily followed.

There is much discussion of the work carried out on animals, not so much in relation to the nutritive peculiarities of, or the needs of animals, but rather to illustrate the facts or suppositions of nutrition as a subject. In consequence of this, the worker concerned with application rather than fundamentals will, we fear, be disappointed and will not benefit to the extent that will the doctor, dentist, physiologist or research worker. It might be said in criticism that throughout the book the impression is left with the reader that the authors have hardly paid due attention to the differences in nutritional requirements and mechanisms that exist between species. There are profound differences between the nutrition of the rodent and that of the ruminant, between that of the herbivore and that of the carnivore, and even more between the nutritional requirements of mice and those of men. These facts, we suggest, have not even yet been sufficiently clearly appreciated by so many workers in modern fields of pure nutrition.

So far as our own immediate problems are concerned, references to lesions and diseases in domesticated animals produced by specific nutritive deficiencies are numerous. The work of American veterinarians on nutritive diseases of animals receives attention, but some at least of the work on nutritive problems in animals carried out by European veterinarians seems to have escaped attention while that of others is given but a scanty passing reference. The reason may well be that so much of our work is specific to the animal in a given environment, which may find no exact parallel in other parts of the world and observations made in Britain may not necessarily be confirmed by others. It would probably also be true to say that publication of the results of work is frequently made in journals and periodicals which may not be readily available in other parts of the world.

In spite of this limitation the book is a valuable one, and though not of much immediate help to the practitioner it will be found of immense interest by those who wish to obtain a grasp of the science of nutrition.

Weekly Wisdom

Within the community the appeal may be either temporal or spiritual—the politician offers less work for more pay, the priest promises a brighter heaven or threatens a hotter hell; but it is always an appeal to some aspect of the self preservative instinct.—"Instincts and the Herd." Abbie, A. A. *Med. J. Aust.* (1941.) **11**. 615-220.

ROYAL COLLEGE OF VETERINARY SURGEONS

Membership Examinations (December, 1942)

LIST OF SUCCESSFUL CANDIDATES

(*Continued from Vol.* 54, *page* 547)

Dublin

First Year:

Brown, Samuel	Murphy, John
Byrne, P. F.	Nicholson, J. T.
Carroll, W. M.	O'Brien, Cornelius
Devlin, O. K.	O'Leary, Harry
Dineen, Charles	O'Rourke, J. J.
Henigan, M. J. (C)	Polden, A. W.
Hickey, T. F. (B)	Quaid, Thomas
Jennings, Richard	Rackard, N.
Kavanagh, Desmond	Richards, R. D.
McCann, W. J.	Skuse, H. G.
McKinstry, Miss B.	Weir, Edward
Mundy, W. A.	Wiltshire, F. H.

(C) denotes credit in Chemistry.
(B) denotes credit in Biology.

Second Year:

Bourke, J. P. (H)	Kealy, B. A. (H)
Byrne, J. J.	Kelly, W. H. B.
Byrne, P. J.	McCarthy, J.
Canavan, R. J.	McDonald, Robt.
Coe, Thomas	McFerran, A. M.
Conlon, P. K.	McGroarty, D. J.
Cosgrove, J. F. (H)	McNeill, J.
Curtin, Sean (P)	Ross, J. K.
Erskine, R. G. (H)	

(P) denotes credit in Physiology, etc.
(H) denotes credit in Histology, etc.

Third Year:

Black, R. A.	Marshall, J. V.
Buckley, A. R.	Mone, P. B.
Cooper, R. J.	Murphy, Laurence
Gavagan, P. B.	O'Brien, W. B.
Harris, K. A.	O'Moore, L. B. S. (A)
Hunt, T. G.	Owens, C. P.
*Kay, E. D.	Sweeney, P. A.
McBride, P. S.	Young, J. A.
MacOnkey, W. I. (A) (H)	Yourell, Miss J.

* denotes 2nd class honours.
(A) denotes credit in Anatomy.
(H) denotes credit in Hygiene.

Fourth Year:

Bourke, S. E.	McNelis, N. J.
Connolly, G. F.	O'Connor, J. G.
Cranley John	O'Regan, R. J.
Dalzell, Kenneth	Paul, C. B. (Paras)
Dolan, M. M.	Power, J. H.
Fitzgerald, Miss P. P.	Roe, M. C.
Geaney, David	Smyth, Arthur
Jackson, T. W.	Tyrrell, J. T.
Leonard, T. B.	Wildman, W. D.
McCarroll, J. J.	

(Paras) denotes credit in Parasitology.

Final Year:

Allison, P. T.	Marshall, D. R.
Condron, G. C.	Mockler, T. V.
Forgie, S. A.	Murphy, R. T. M.
Good, N. S.	O'Keeffe, Daniel
Harrington, D. P.	Parker, I. V. G.
Jones, A. R.	Pollock, Alexander
Mahony, I. J.	Thornberry, Henry

"One of the good things which have come out of the war is that over two million acres of land have been properly drained in Great Britain. The Germans have got their food by taking it from other countries: we have got ours by improving the land."—Sir John Russell, Director of Rothamsted Experimental Station, at Derby.

* * * * *

"Meat ration may be cut"—The determining factor being the knife and the meat.—*Punch.*

NOTES AND NEWS

The Editor will be glad to receive items of professional interest for inclusion in these columns.

Diary of Events

Jan. 12th.—R.C.V.S. Committee Meetings, Royal Station Hotel, York.
Jan. 13th.—R.C.V.S. Committee and Council Meetings, York.
Jan. 14th.—Meeting of the Society of Veterinary Practitioners at Bristol, 2 p.m.
Jan. 15th.—Meeting of the Society of Veterinary Practitioners at Exeter, 2 p.m.
Jan. 15th.—Meeting of the Sussex Division, N.V.M.A., at Brighton; informal luncheon 1 p.m.; meeting 2.15 p.m.
Jan. 16th.—Meeting of the Society of Women Veterinary Surgeons at Birmingham, 2.15 p.m.
Jan. 21st.—N.V.M.A. Committee Meetings at 36, Gordon Square, W.C.1.
Jan. 22nd.—Quarterly Meeting of Council, N.V.M.A., followed by a Special Meeting of Council to discuss veterinary education at the Connaught Rooms, Great Queen Street, Kingsway, W.C.2.
Feb. 4th.—Meeting of the Central Veterinary Society (Division, N.V.M.A.) at the Conway Hall, Red Lion Square, W.C.1, 2.30 p.m.

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N.V.M.A. Council and Committee Meetings

The attention of members concerned is drawn to the meetings of Council and committees, N.V.M.A., notified above, in order that they may make the requisite arrangements to attend.

* * * * *

PERSONAL

The New Year Honours

VETERINARIANS' AWARDS IN THE ORDER OF THE BRITISH EMPIRE

The New Year Honours List contains the welcome notification of awards, all within the Order of the British Empire, to four members of the veterinary profession, and on behalf of their colleagues we congratulate them upon this recognition of distinguished service.

In the Colonial Office List, in the Military Division of the Order, there is notified the conferment of the C.B.E. upon Brigadier John J. Macfarlane Soutar, O.B.E., M.R.C.V.S. (late R.A.V.C.). In the Civil Division the following awards are made: Mr. Robert J. Simmons, M.R.C.V.S., Director of Veterinary Services, Uganda, receives the C.B.E., and Mr. Robert J. Roe, M.R.C.V.S., D.V.S.M., Chief Veterinary Officer, Cyprus, the O.B.E., as does Mr. George Vincent Slinn, M.R.C.V.S., Superintending Inspector, Animal Health Division, Ministry of Agriculture.

Some of the awards to the representatives of human medicine and of agriculture are of special interest. Sir Charles Wilson, President of the Royal College of Physicians, becomes a Baron; Sir William Jameson, Chief Medical Officer to the Ministry of Health and Board of Education, a K.C.B., and upon Sir Henry Hallett Dale, lately Director of the National Institute for Medical Research and the President of the Royal Society, is conferred the G.B.E. in the Order of the British Empire. Among notable agricultural Honours, Mr. Thos. Baxter, Chairman of the Milk Marketing Board, becomes Knight Bachelor, and Mr. E. H. E. Havelock, Administrative Secretary to the Agricultural Research Council and Chairman of the Development Commission, is awarded the C.B.E. in the Order of the British Empire, as is Mr. W. J. Cumber, Chairman of the Farmers' Club.

* * * * *

Birth.—WILLIAMS.—On December 27th, to Beryl (*née* Wilson), M.R.C.V.S., wife of H. H. O. Williams, M.R.C.V.S., of Tycroes, Anglesey, a daughter.

* * * * *

Marriage.—WITHERINGTON—GRIEVE.—On December 21st, at West Buccleuch, Hawick, Lieut. Douglas H. Witherington, R.A.V.C., to Christina G. Grieve, M.R.C.V.S.

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R.C.V.S. OBITUARY

MASHETER, J. W. Hall, Ruddle House, Newnham-on-Severn, Glos. Graduated Edinburgh, May 24th, 1893. Died January 4th, 1943; aged 70 years.

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UNIVERSITY OF LONDON

The following announcements appear in *The University of London Gazette.*

Personnel of Boards of Examiners, 1943

(The Examiners whose names are marked with an asterisk have been appointed Chairmen of their respective Boards.)

SECOND AND THIRD EXAMINATIONS IN VETERINARY SCIENCE

Veterinary Anatomy.—E. C. Amoroso, *J. McCunn and the External Staff Examiner.
Veterinary Physiology.—*J. Y. Bogue, W. R. Muir and the External Staff Examiner.
Veterinary Hygiene.—W. C. Miller, *G. H. Wooldridge and the External Staff Examiner.
Veterinary Pathology.—*T. J. Bosworth, R. Lovell and the External Staff Examiner.

EXTERNAL STAFF EXAMINERS, 1943

Veterinary Anatomy.—J. S. A. Spreull, PH.D., M.R.C.V.S.
Veterinary Hygiene (Agric.).—K. D. Downham, B.V.SC., M.R.C.V.S., D.V.H.
Veterinary Hygiene (Vet. Sci.).—Prof. R. G. Linton, PH.D., M.R.C.V.S.
Veterinary Pathology.—G. O. Davies, D.V.SC., M.R.C.V.S., D.V.H.
Veterinary Physiology.—Prof. R. J. Brocklehurst, M.D., D.M., B.CH.

. . . . .

University Roll of Honour

(From *The University of London Gazette*)

*CRITTALL, D. P. (R.V.C.), R.A.F.V.R.
Killed early in the war.

DIXIE, E. A. W. B. (R.V.C.), T/Capt., Oxford and Bucks L.I.
Killed in action at Cassel, near Dunkirk, May 25th, 1940.

*HILL, R. B. D. (R.V.C.). Sgt. Pilot, R.A.F.V.R.
Killed in operational flight over Berlin, September 7th, 1941.

MCCUBBINS, W. J., B.SC. (R.V.C.), Veterinary Officer, Nigri Sembilan, F.M.S.
Killed at Singapore, January, 1942.

O'REILLY, L. B. (R.V.C.), Pilot Officer, R.A.F.V.R.
Shot down in daylight bombing raid over Boulogne, July 10th, 1941.

REFFELL, A. D. (R.V.C.), Pilot Officer, R.A.F.V.R.
Crashed on return from operational flight, February 20th, 1942.

SOOTHILL, P. L. (R.V.C.), Pilot Officer, R.A.F.V.R.
Killed as result of aircraft accident, February 16th, 1942.

* denotes ex-officer cadet of the University of London O.T.C.

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CASUALTY SLAUGHTER AND VETERINARY CERTIFICATES

In certain cases the Ministry of Food has found it necessary to inform dealers and others that it will not accept animals from them at Government slaughterhouses under the casualty procedure, other than animals where it is obvious that slaughter is immediately necessary, unless a veterinary certificate is provided in respect of each animal indicating the reason which makes immediate slaughter necessary.

A veterinary surgeon who is asked to give such a certificate should be careful to note that what is wanted is a certificate stating that the particular animal is suffering from some injury or illness which necessitates its immediate slaughter. He should, therefore, set out in his certificate as complete a description of the animal as will enable the authorities who deal with the case to identify it. In addition to the general description of the animal, its approximate age and a description of the nature of the injury (or illness) will help towards identification.

Needless to say the certificate should be carefully written on the veterinary surgeon's own notepaper and should show that it is in fact a certificate issued by a registered veterinary surgeon. This reflection is caused by the perusal of a certificate brought to our notice which was scribbled in pencil on a torn sheet of paper without any printed heading and worded as follows: "This is to certify that a red and white Hereford cross steer calf should be slaughtered for humane reasons and examined for food purposes by X.Y.....Address.....Signed.....M.R.C.V.S."

It will be noticed that this certificate does not fully identify the animal to be slaughtered, nor does it indicate the condition from which it was suffering. It might have been written by any uneducated or irresponsible person. Such a document is, of course, evidence merely that the veterinary surgeon in question was careless and slovenly, but unfortunately it also tends to create a very unfavourable impression—wholly unjustified—of veterinary surgeons in general. If the injunctions mentioned above are followed no such criticism will be merited.

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NATIONAL SERVICE ACT, 1942

MEMORANDUM OF GUIDANCE

The Board of Education and the Ministry of Labour and National Service have issued a memorandum of guidance (A.M. 436, dated December 18th, 1942) on the registration of boys born in 1924 and 1925. Copies have been sent to local education authorities

for higher education, governing bodies of non-L.E.A. schools, vice-chancellors and principals of universities and university colleges, university joint recruiting boards, headmasters of secondary schools, and principals of technical institutions. The following summary presents the main points in the memorandum as affecting veterinary students.

Boys of the 1924 age class now at universities who have already been accepted by the Joint Recruiting Board for technical and scientific courses should continue their studies under present arrangements. Boys wishing to be reserved under the Schedule of Reserved Occupations should produce evidence at the time of registration that they can satisfy the conditions. If this is not possible, the necessary evidence should be forwarded at the earliest possible date to the local office of the Ministry of Labour shown on the student's certificate of registration (N.S.2). No student can be reserved once an enlistment notice has been issued.

Veterinary surgeon students are reserved if they have passed their first professional or equivalent examination. Boys born in the second half of 1924 who have begun a course of study for, and intend to take before July 31st, 1943, the first professional or equivalent examination will have their calling-up deferred until July 31st on production of the headmaster's certificate. Veterinary surgeon students required to register before July 31st, 1943, who are studying for first professional or equivalent, and intend to take the examination by July 31st, will be deferred till that date. A certificate must be produced.

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DOGS FOR WAR SERVICE

Suitable dogs for War Service are urgently required on loan for the duration of the war for employment by the Army and other Ministries.

It is, therefore, desirable that no dog of potential use to the State should be destroyed on account of food shortage or other difficulties of maintenance associated with war-time conditions.

The responsibility for the provision of dogs is vested in the Director of Army Veterinary and Remount Services, who would be grateful for the co-operation of members of the profession in dissuading the public from having young, intelligent and healthy dogs of suitable breeds destroyed, whilst opportunities exist for their useful employment on War Service.

Suitable dogs of the following breeds are required particularly: Alsatians, working Collies and Airedales. Crosses of these breeds and also Bull-terriers, Lurchers, Elk-hounds, Himalayan Sheepdogs, Boxers and Rhodesian Ridge-Backs are also usually worth a trial. Few gun-dogs hounds or terriers and, of course, none of the toy breeds are useful.

Within the breeds specified as potentially suitable, intelligence and obedience are the essential qualifications. Youth (9 months to 2 years) is a considerable advantage, but greater age is not always a bar to acceptance.

Registration of dogs can be carried out by any Inspector of the R.S.P.C.A. or Canine Defence League, who will also furnish full particulars of the War Dogs Training Scheme. The address of the nearest Inspector can be obtained from the local police station.

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"THE SCOTTISH FARMER": A JUBILEE REFLECTION

Commenting in its current issue on the notable fact, upon which we heartily congratulate this valued agricultural journal, that by completing 50 years of publication, *The Scottish Farmer* has attained its Jubilee, the paper observes: "As we enter upon our second half century, the nation has come to realise, as it never has realised during the past 50 years how important and how necessary agriculture is for the country's welfare. We trust that the lesson so painfully learned will not be lightly forgotten; that after the war there will be no reversal of agricultural policy such as occurred after the last war; and that the people will appoint statesmen who have the wisdom, when framing the nation's future policy, to give the farming industry its rightful place and not allow it to be sacrificed as in the past to all other interests; in short, that agriculture, instead of being regarded as the least of our industries—which is how it was regarded during the greater part of the past 50 years—shall in the future be regarded as the greatest."

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ROYAL ARMY VETERINARY CORPS

The following announcement is made in the issue of *The London Gazette* dated December 15th, 1942:—

The undermentioned to be Lts.:—

John Fender Douglas (250766), November 5th, 1942; Douglas Harold Witherington (250963), November 12th, 1942; Andrew Kerr Kirkwood (252749), November 17th, 1942; Alan Arthur Wilson (252412), November 18th, 1942.

THE GOVERNMENT AND POST-WAR RECONSTRUCTION

Among the appointments announced by the Government at the end of the year were those of Sir William Jowitt as Minister without Portfolio, Mr. W. S. Morrison as Minister Designate for Town and Country Planning, and Mr. H. G. Strauss as Parliamentary Secretary-Designate for Town and Country Planning.

Sir William Jowitt will continue his existing duties in regard to post-war reconstruction problems and will have access to the War Cabinet for the purposes of this work. This appointment will take effect forthwith, but the others will not take effect until the legislation setting up the new Ministry of Town and Country Planning, which will be introduced shortly, has received the Royal Assent.

* * * * *

FOOT-AND-MOUTH DISEASE IN SCOTLAND

"Foot-and-mouth disease this week appeared in one of the most famous herds of Shorthorns in the country—that maintained at Aldie, Ross-shire, by Mr. Finlay MacGillivray," stated *The Farmers' Weekly* in its issue of last week, and continued: "The herd numbers between 80 and 100 cattle and is worth many thousands of pounds. A considerable number of the herd were affected by the disease. High veterinary officers of the Ministry of Agriculture discussed for some hours on Wednesday the possibility of isolating and treating the cattle in view of their great value to the breed, but in the evening it was announced in London that no exception to the slaughter policy could be made." During the same period outbreaks were confirmed among cattle at Canon Bridge and Middlefield, Muir of Ord, also in Ross-shire.

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H.M. STATIONERY OFFICE PUBLICATIONS

The undermentioned have been published recently. Copies can be purchased through any bookseller, or directly from H.M. Stationery Office.

	Price net s. d.	*Post free* s. d.
STATUTORY RULES AND REGULATIONS:		
2521. Feeding-stuffs. (Regulation of Manufacture) Order, 1942. Amendment Order, Dec. 10th	0 2	0 3
2539. Milk Marketing Board (Modification of Functions) Order, Dec. 11th	0 1	0 2
MEDICAL RESEARCH COUNCIL:		
War Medicine. Bulletin of. Vol. III, No. 4, Dec., 1942. (45-10-3-4)	1 3	1 5

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LEGAL NOTES

Sale of Milk from Cow Affected with Septic Mastitis.—In the first case of the kind to be brought in Norfolk, John Joseph Carter Bartram, farmer, of Lyngate Farm, North Walsham, was fined £5 and £1 1s. costs at North Walsham for selling milk for human consumption from a diseased cow between September 29th and November 16th.

Miss A. Lauriston prosecuted on behalf of the Norfolk County Council. Bartram pleaded "Not guilty."

A veterinary surgeon, Mr. Alexander H. Dawson, of North Walsham, said an examination of one of Bartram's cows, called "Trixie," on September 29th revealed that it was suffering from septic mastitis.

The County Sanitary Inspector said defendant held a licence from the N.C.C. for the production of accredited milk. The herd was inspected regularly and the last clinical examination was on September 29th. It was then found that two cows were suffering from conditions which prohibited their being retained in the herd until they were cured and then pronounced fit by a veterinary surgeon. The usual pink form was posted by Mr. Dawson, and this was followed up by the N.C.C. drawing defendant's attention in writing to his obligation. On October 20th Bartram replied that he was sending both animals to the North Walsham depot on October 29th "for disposal" and this was regarded as satisfactory.

In view of the County Public Health Committee's concern regarding the prevention of milk-borne infections, witness made further enquiries regarding these animals and found that one had been disposed of as stated by defendant, but that no evidence that the cow "Trixie" had passed through the North Walsham depot was available. He accordingly again visited the farm during the afternoon milking of November 18th. He saw the cow "Trixie" being milked by Bartram and her milk was being mixed in the

dairy with the milk of the cows for disposal to retailers. Both Bartram and the cowman replied in the affirmative to his question whether "Trixie" had in fact been continuously milked and her milk mixed with that from the other cows since the veterinary inspector's examination. Witness asked defendant if he had obtained a further veterinary certificate authorising him to retain the cow in the herd. Bartram said he had not, but that in his opinion there was nothing wrong with the cow.

As a result of further inspection of the cow, witness added, "Trixie" had since been slaughtered, and the *post-mortem* examination revealed also the presence of tuberculosis.

On oath, Bartram first of all said he used the milk for calf-rearing, and then admitted he mixed it with that from other cows, and used what was left over for the calves.

Mr. F. T. Dewing, presiding, said the Bench regarded the offence as a very serious one.

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CONTROL OF LIVESTOCK (SCOTLAND)

The Secretary of State for Scotland has made an Order entitled the Livestock (Control) (Amendment) (Scotland) Order, 1942, amending Article 7 (*a*) of the Livestock (Control) (Scotland) Order, 1942.

The purpose of the amendment is to make it clear that whereas the prior consent of the Secretary of State is necessary in the case of a direction by an Agricultural Executive Committee requiring a farmer to keep any kind or type of livestock which is not already on his land, such consent is not necessary in the case of a direction requiring a farmer to keep an increased number of any kind or type of livestock which is already on his land.

Copies of the amending Order may be obtained from H.M. Stationery Office, 120, George Street, Edinburgh, 2, or through any bookseller, price 1d. net.

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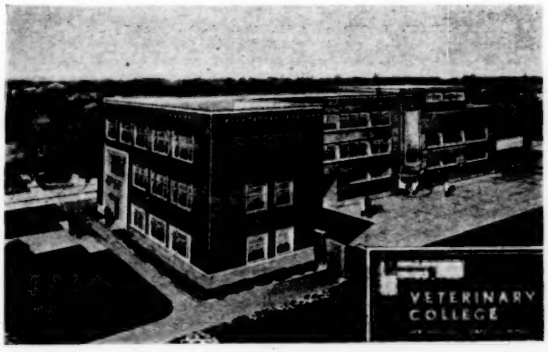
DUBLIN COLLEGE BUILDING EXTENSION

The accompanying illustration is that of the proposed extension of the Veterinary College of Ireland, Dublin. Unfortunately the erection of this structure has been held up owing to lack of material, only a small portion of the building having as yet been proceeded with, and this has been converted into air raid shelters for the duration of the present emergency.



This extension has been made possible by the Governing Body of Trinity College, which very generously granted an adjoining strip of the Trinity Botanic Gardens in order to permit the front of the College to reach Pembroke Road on the site of the former Principal's house. This building will be ⌊‾‾ shaped, having a square block fronting Pembroke Road and a rear block backing Trinity Botanic Gardens. The front block will contain administrative offices, library, board room, pathology museum, parasitology museum and a number of private rooms, while the rear block will be largely an extension of the present pathology department which is now mainly devoted to the poultry and canned meat sections; also included in the rear block will be the chemistry and biology departments for the teaching of first year students.

At the rear of the College, on Shelbourne Road, an adjoining dairy yard has recently been acquired, where it is proposed to erect another new department for clinical and research work on the larger animals, particularly cattle, sheep and pigs.

Two years ago the present college was reconstructed and new departments for small-animal clinic, physiology, hygiene, pharmacology and parasitology have been added.

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ANOTHER DOMESDAY BOOK

Under the above heading *The Times* in a recent issue observes: "For months past the Ministry of Agriculture has been collecting information in every county for a modern Domesday Book, and the task is well on the way to completion so far as the field work is concerned. One object of the first Domesday Book was to see how much money could be extracted in taxes from agriculture. The aim of the present farm survey is different. It is to find out the shortcomings of farms and farmers and show what needs to be done immediately and after the war to improve the efficiency of our agriculture. Every farm of over five acres in the country is being covered—about 300,000 holdings altogether—and a detailed record made of the conditions of tenure, the state of the farm, its equipment, whether or not it has a supply of water and electricity and the degree of the present occupier's efficiency as a farmer. This confidential report on each farm is to go with the census return of crop acreages and livestock numbers and a plan of the farm showing its boundaries. All this information taken together provides a fairly complete record of the farm.

"This survey has already proved valuable to the county war agricultural committees which are responsible for the field work. Where the survey has disclosed faults and failures on a farm committees have been able to follow up the report and see that the farmer has the guidance and facilities needed for improvement. In post-war planning the farm survey should be most useful. It is already all too clear that the provision of more farm workers' cottages of good type with modern equipment is an urgent need. Lack of a proper water supply or electricity is also a handicap that can be remedied. The plans of farms are likely to be useful in determining the better class of agricultural land which should be reserved as such and protected from building development. The mapping of farms has already confirmed that many farms are most inconveniently laid out. Thousands of so-called farms are mere parcels of land strung out over several parishes. Consolidation of holdings to make more efficient farming units is certainly one of the problems to be tackled. While it is too early to draw conclusions from this farm survey, the fact that it is being carried out in the stress of war is a hopeful sign of realism about post-war plans for agriculture."

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SLAUGHTER OF NAGANA-CARRYING GAME

Finality has now been reached in the controversy over the shooting of game on farms bordering the Umfolozi and Hluhluwe reserves in Natal. There has been an outcry that wholesale slaughter was going on of nagana-carrying game, but the Veterinary Department, including Dr. P. J. du Toit, of Onderstepoort, have pointed out that the slaughter of game is the only solution to a serious problem. The Government's decision has been slightly modified, and there is now no indiscriminate shooting. But adjoining farms have been issued with rifle ammunition on the condition that their aim is to restore the balance of Nature by removing the danger of overstocking of big game. It is pointed out that small game are less dangerous in spreading nagana, and small buck generally are excluded from the order to "shoot at sight." It is hoped that the shooting will drive large numbers of game back to the reserves, thus minimising the danger to cattle.—*South Africa.*

CORRESPONDENCE

Letters to the Editor should reach the Office not later than by the first post on Monday morning for insertion in following Saturday's issue.

The views expressed in letters addressed to the Editor represent the personal view of the writer only and must not be taken as expressing the opinion or having received the approval of the N.V.M.A.

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INFERTILITY IN CATTLE

Sir,—In a letter in these columns (November 21st, 1942) criticising sex hormone therapy, Mr. J. Edwards seeks to establish the thesis that "hypoplastic genitation" in heifers and *post-partum* anoestrum in cows are the direct result of inadequate nutrition and incorrect management. Mr. Edwards, however, does not mention that the anoestrous state in cattle of all ages is by far

the most commonly encountered in the early winter and early spring months. It seems to me that there are two reasons for this, *viz.*: (1) the internal sex rhythm which, in spite of domestication, tends to direct the breeding activities of cattle towards the season at which they were naturally exhibited by their wild ancestors—Professor F. H. A. Marshall has directed attention to this aspect of reproduction in a recent review, which merits study by all veterinary workers in this field—and (2) the lower nutritional plane at which cattle, whether wild or domesticated, are of necessity maintained during the winter months. That the great majority of dairy cattle can and will breed outside what may be regarded as the natural season is evidence that man by selective breeding has evolved a more useful animal for his purposes and by practising modern methods of food conservation has enabled this animal to be successfully bred at will instead of at times governed by an intermittent food supply as in Nature.

Pertinent to any consideration of sex hormone therapy is the fact that the evolution of the modern dairy cow has resulted in an animal in which the whole endocrine system must be regarded as grossly abnormal. There is ample evidence that there must be complete readjustment of all the sex endocrine relationships before a cow can produce a high and continuous milk yield. That this readjustment is genetic there can be little doubt and the degree to which it has been achieved is a measure of the success of man's directive breeding. The evolution of the beef breeds, on the other hand, has been along other lines and here the sex endocrine relationships have been more or less maintained in the natural state, so that less is heard of infertility in this variety than in the dairy breeds.

Bearing the above facts in mind, it is surely not illogical to practise sex hormone therapy in an animal group in which the hormonal system is already out of natural gear as evidenced by the *abnormal* production of milk. By so doing it is possible to bring into production those animals which have not been able completely to readjust their hormonal mechanism. Such animals may legitimately be regarded, in a sense, as not having reached complete evolutionary development.

I would, with Mr. Edwards, deprecate the indiscriminate use of hormone therapy in sterility, but it seems to me that he has magnified the extent to which this form of treatment is being used. It is most certainly only in a small proportion of the total dairy cattle population that hormone therapy will prove beneficial.

In a more recent letter (December 19th, 1942) Mr. Edwards writes that ascorbic acid is being very extensively used in the U.S.A. as a means of treating infertility in cattle. Workers in this country are already familiar with the researches of Phillips and his co-workers at Wisconsin on this subject. I have had the good fortune to secure the co-operation of a number of practitioners in Southern England in testing the value of this form of therapy in appropriate cases of sterility. We are still far from satisfied that it results in beneficial effects on sterility in the female as met with in Britain.

In conclusion, I am in agreement with Mr. Edwards that further research is necessary on all aspects of bovine sterility. It is my view that progress will be made only when a special centre devoting all its attention to this problem has been instituted, and staffed by the necessary team of veterinarians together with specialists in nutrition, chemistry and endocrinology.

Yours faithfully,
N. J. Scorgie.

The Royal Veterinary College,
Holme Park,
Sonning, Reading.
December 20th, 1942.

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DIAGNOSIS OF PASTEURELLOSIS

Sir,—In *The Veterinary Record* of December 5th, Mr. Dawson published an article on "Pulmonary Pasteurellosis in Home-Bred Cattle" and claims to have diagnosed the presence of pasteurellosis on the ground of having seen bipolar-staining organisms in films made from heart blood, lung and trachea: without stating any further tests which he may have applied for the definite identification of these organisms (or which might have been made for him by a laboratory), he refers to them as *Past. boviseptica.*

My object in writing this letter is to point out that, in my experience, after two and a half years' intensive work on the genus "Pasteurella," I find considerable difficulty in making a definite diagnosis of pasteurellosis. In *The Veterinary Journal*, January, 1942, I published an article in which I drew attention to a pneumonia in cattle, from the lungs of which, bipolar-staining organisms were isolated and which, biologically, were quite different from *Past. boviseptica*, and were non-pathogenic. It should be pointed out that the bipolar-staining character of organisms is not confined to the Pasteurella group. I have in my possession a strain of Salmonella isolated from the lung of a cow which is pathogenic for mice and rabbits and which shows definite bipolar-staining in films of heart blood and peritoneal exudate from these animals.

Yours faithfully,
M. H. Kyaw.

c/o The Veterinary Laboratory,
New Haw,
Weybridge,
Surrey.
December 22nd, 1942.

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CANINE CRAMP

Sir,—I am glad Mr. Bateman takes such a broad view of cramp in the greyhound. It has always seemed to me that physiology and temperament were insufficiently studied and observed by us in canines. In a fairly large canine practice I consider that one has to deal with about four different temperaments in dogs which I class as:—

1. *The sanguine* (full of the joy of life).
2. *The phlegmatic* (not even disturbed by "blitzes" or thunderstorms.)
3. *The nervous* (greatly upset by strange noises).
4. *The melancholic* (*e.g.*, Dandie Dinmonts and bloodhounds).

All these react in different ways to external stimuli and need different methods of approach and treatment (if necessary).

We all know, or should know, that "physiology deals with the healthy functions of different organs and the changes the whole body undergoes in the course of its activities." Hence the importance of noticing and observing the effects of diet, digestion and exercise.

I have no experience of cramp in greyhounds, but I have had several cases of different breeds of dogs walking on their forelegs with their hind legs held high up in the air, and have attributed it to injury to the loins or spine. Nerves control muscles and primarily probably the nerve supply is injured or inhibited.

Yours truly,
G. Mayall.

Bolton.

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STILBOESTROL IN TREATMENT OF PYOMETRA IN THE BITCH

Sir,—It was with the greatest interest that I read Mr. Storey's communication on the treatment of pyometra in the bitch with stilboestrol. It is most gratifying that he has added his clinical reports to those of Messrs. R. C. G. Hancock and R. J. Smith Leask, since the treatment of this condition with stilboestrol is still apparently only in a very experimental stage.

I notice, however, that Mr. Storey has mistakenly associated me with Messrs. Hancock and Smith Leask in the administration of large doses of stilboestrol. If he will re-read my original communication he will see that I used only very small doses. Actually I computed the doses on a weight basis from the known doses in the larger animals. I consider this point important, since I feel that over-dosing with this oestrogen may lead to recurrence (especially in cases of "sterile" pyometra). Since making my first communication I have had further experience of stilboestrol in the bitch and have not found it necessary to increase the doses.

Mr. Storey's theory regarding the accelerated absorption of toxins following the administration of stilboestrol is a very interesting one. I believe it happens in "infected" pyometra and I believe the toxaemia can be prevented, in part, by a variety of means. I hope to report on this matter from clinical experience in the near future.

It appears to me that there is a very great difference between the so-called "sterile" pyometra and the infected, or feverish type, and I cannot believe that stilboestrol alone will prove a cure for all forms. Like Mr. Storey, I have used stilboestrol in conjunction with sulphanilamide therapy. I have also followed up the parenteral administration of stilboestrol by oral use of the oestrogen. I believe there are cases in which this is most useful.

If I may, I should like to submit some further clinical data on the use of stilboestrol at an early date.

Miss C. G. Grieve's report on a case in which stilboestrol produced oestrus but not abortion is very interesting. In two of my cases the oestrogen produced contraction of the uterus with expulsion of its contents, but no signs of oestrus.

Yours faithfully,
Miller Watson.